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SIDE LIGHTS
ON THE
WAR

WILLIAM L. NIDA

HALE BOOK CO.
OAK PARK., ILL.



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SIDE LIGHTS ON THE WAR

For
Upper Grades and High Schools

BY
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"Dawn of American History," "City, State and Nation,"
"Story of the World War for Young People," Etc.

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FOREWORD

It is dawning upon all school authorities, and especially upon those who make the courses of study, that since this World War stands mountain high above all other events of history it must have a large and growing place in the school program.

The problems of today and the magnificent way in which they are being solved constitute the most vital and stimulating material that can be put in the hands of teachers and pupils.

The school boys of today are the men of tomorrow who must face the questions of the reconstruction period. Let us spend a little less time with Caesar and Napoleon and a little more with the great leaders of today with their triumphs and problems.

The object of this book is to make many of these present questions clear and put them into convenient form for discussion in the class room.

W. L. N.

Part I

CHAPTER I

THE MAKING OF AN AVIATOR

In the early days of the war American boys hurried to Europe to be trained in the art of flying by the French, British and Italian aviators. But now Uncle Sam is training his men to fly at home. Our great camps for the making of airmen were soon in working order. From the beginning of the war, a large number of men offered themselves for the aviation branch of the service. They were eager to try its new experience and its risks. In fact, so many applied for air service that a large number had to be rejected.

Our government has severe tests for an airman. He must pass a thorough physical and mental examination. College men are preferred, **AIRMEN'S HARD TESTS** because flyers must have at least a slight knowledge of many of the sciences. The heart and lungs of the flyer must be perfect, for he must endure high altitudes. His eyes, too, must be without flaw, for he must scan the horizon for miles. He must be able to look through the fogs and observe the details of the land that the enemy occupies. His body, too, must be strong and supple, with no weak spots that might give way under strain. His mind and muscles must act together with lightning quickness, because there are many times when his life may depend upon the right use of a hundredth part of a second. The airman must know how to give himself to team work in the skies. He must have courage, for there are deadly perils ahead; but,

above everything else, he must have good judgment and a good working mind. If he errs in a report to his base, the result may be the destruction of thousands of men or the loss of a battle.

There are several steps in the making of an airman. The first step is taken in a "ground school." Most of these are in American universities. The second step is at one of the great flying schools of the government, and the third step is in France, just behind the fighting lines.

An aviation cadet must attend the ground school for eight weeks and pass a stiff mental test. No lad **THE GROUND SCHOOL** without a good head gets through. Here he learns about engines. He studies every part of his machine right side up and upside down. He knows when it is in disorder and needs repair and how to repair it while coasting down the wind over the enemy country. He must know all about the stress on the wings and the arrangement of wires and braces to make his airplane strong. Some day he may have to dive straight down for a mile at an enemy's balloon. When he suddenly checks his wild fall he must know how to do it without snapping the cables and the binding wires of his machine. He must know, too, about different types of machines and for what each is intended.

There is the Morse telegraphic code, which he must know well and must practice every day for weeks. He must know the code so well that he can translate it at the moment he gets it without even writing it down. With it comes the science of telegraphy and wireless. Among all these difficult tests many a lad has been lost to the game of flying.

The aviator also must know much about the stars, so that he can direct his course by them at night. He must have a knowledge of the winds and how they behave. For instance, if he should be traveling

at fifty miles an hour across a wind that blows fifty miles an hour to his right and he should turn to the right he must know that he would fall to the ground like a plummet. In such a case the wind would be going the same direction, and just as fast as his machine, and there would be nothing to hold his machine up, because it is kept up always by the motor pressing on the air.

The young airman must also understand how to use a camera, how to take photographs over the line **PHOTOGRAPHY FROM THE SKY** enemy. By comparing these photographs each day, he can see what changes are being made and what the enemy is doing, for should he attempt to camouflage, or to conceal or disguise his movements, the camera must reveal his plans.

Sometimes an airman is sent up for a snap shot which must be gotten quickly. He passes through a storm of shrapnel, gets his picture and returns and has it developed by the speediest method known to science, and within half an hour it is in the hands of the officers who are directing the troops and those who are operating the big guns.

At the ground schools there are wonderful relief maps which show the landscapes as they appear from **CORRECTING THE RANGE** the sky. One of these may occupy the floor of the class room. Twenty feet above this floor is a balcony from which the students look down, just as a flyer would look down from the air. These relief maps are very clever devices. They represent battle fields with trenches and pill boxes with gun positions. They are electrically wired so that shell bursts may be shown. The instructor, by pressing a button, may have the shell burst wherever he likes, as it might do upon a real battle field. The cadet in the balcony above is the spotter who corrects the range for that battery. He observes the flash of the shell with relation to

the target. Then he telegraphs back how to change the range so as to hit the target, and he must telegraph with the Morse code. Thus the student aviator is actually doing in his class room just what he would have to do when he is alone in the skies as a flyer for Uncle Sam.

The cadet must also be familiar with the machine gun. He must know it as well as he does the bean-**MACHINE-GUN** shooter of his boyhood; he must learn **EXPERT** to take it apart and put it together; he must be able to put cartridges into it with his left hand while his right hand directs his machine, for you know he must maneuver his machine, operate his gun, take pictures, use his wireless and do many things at once when flying. Thus you can see he is a busy student during his eight weeks in the ground school.

Now he is ready for the government's Aviation Field and eager to make practice flights. There are a number of government Aviation Fields scattered over the country. Several of them are in Texas and other southern states where outdoor conditions are fine the year round.

When a cadet first ascends into the air, he goes in a two-seater with an instructor. After watching **TRIAL** his instructor for a time, he takes over the **FLIGHTS** control of the airplane and has the instructor correct any mistakes he may make. Presently the learner is running the machine alone. At first the flights are short and there are many landings; then the day soon comes when the cadet goes aloft while his instructor watches him from the ground and corrects afterwards any mistakes he has made. Presently he is ready for his final test. He must fly thirty or forty miles to another station, make a landing, register, and fly back. On another day he must go aloft to an altitude of 10,000 feet, where he will feel the difference in the resistance of rarefied air,

and where it is as hard to climb a hundred feet as it is to mount a thousand feet lower down. Perhaps he will fly for the first time over a great white cloud and behold many beautiful sights and have many thrilling experiences.

Four months of training is expected to show the qualities that are needed for an airman. Then the air cadet is ready for his third stage of training. He is made a second lieutenant and becomes a reserve military aviator. His cadet days are passed and he is an officer in the United States Army.

Then the flyer is off for the front in France, where he gets into the game behind the fighting line in the **OFF FOR** atmosphere of the battle. There he gets the **FRANCE** discipline of the team work and tests his mettle with the battle plane. More and more the battle planes are fighting in squadrons rather than singly. The single fighter is still seen at times, but he is often outnumbered by a squadron of the enemy.

The aviators in France have a few slang expressions that are telling. They call the airplane a "can" probably because of the large gasoline tank. "Going to a pink tea" is going up in the air after a German. A "cuckoo" is an aviator who has all his battles when there is no one to look on and then comes back and tells about it. "Cuckoo birds" are always telling about "pink teas," though they never have any.

When an aviator "spots" an enemy he "jockeys" for position. That is, he gets in a position where he can shoot the enemy and the enemy cannot shoot him. Usually he tries to "get under his tail," which is behind and under him.

When a flyer is at a disadvantage he "zooms" or "dives" or "vrilles" home. If he "zooms" he steers straight home, if he "dives" he goes straight groundward, while if he "vrilles" he dives, turning around like a top so it is difficult to hit him.

CHAPTER II

THE AVIATOR OVER THE FIRING LINES*

Airplanes are the eyes of the gun. Every officer must know exactly how much of the enemy can be **USE OF** seen from the air and at certain heights **BALLOONS** how much the enemy flyers can see his forces. The long distance gunner cannot see his target. Often the commander cannot see his own gun because he is far away in an observation post, noting where the shells fall. He gives his commands by telephone. If there is no high position from which the commander can watch the effect of his fire direct, then he will send up a captive balloon, that is, a balloon held by a wire from the ground. This is sent up far behind the lines, so high that it is out of the enemy's range. Below the balloon is a big basket filled with observers, who are watching where the shells are falling. All the while the enemy is puffing away at this gas bag with incendiary shells. If the bag catches fire the observers tumble out with their parachutes and descend safely.

Sometimes the enemy's battery is so placed that the balloon observer cannot locate it; then they use **AIMING BY** an airplane, which rises higher than the **AIRPLANE** balloon and sails over the enemy's line to get the desired information. In the case of the balloon there are wires running up to it and the gunner talks back and forth from the ground as from one office to another, but you cannot connect wires with an airplane. The flyer carries a wireless and can send messages to the ground where an operator receives them, but the aviator cannot easily receive

*See my World War, Chapter 5.

messages by wireless, though this is sometimes attempted. If you were sitting right beside him you could not talk into his ear with a megaphone and make him hear. It is a terrible deafening noise that is made by a motor two thousand feet up in the air, running at the rate of 100 miles an hour.

Yet, if he cannot hear, the flyer can see. So they signal to him from the ground with large white signs **GROUND** arranged to spell out the words for him. **SIGNALS** These white signs lie flat on the ground. They are seen clearly and easily against the green grass by the man up in the plane. By different arrangements of these signs signals are given to the aviator. Perhaps they tell him to go north and locate a German battery.

In order to observe and photograph enemy country or bomb their works it is necessary to go in formation, a squadron with several machines acting as scouts and protection for the bombing or the observation work near the ground. They must go forward in sufficient numbers to sweep the skies.

The formation of the squadron is interesting. They go up in what might be called terraces. The **FLYING IN** first terrace is perhaps four miles high. **TERRACES** It is made up of the single-seated fighting machines with a speed of 150 miles an hour and the two-seaters with a speed of 110 miles an hour. These are the challengers of all comers and they fight any enemy who may appear. From the advantage of their high position they are ready to swoop down on any enemy plane below and drive him to the ground. These machines which are flying so high are the protectors of the other machines at lower levels.

Two miles up there is another terrace of machines which are also fighters. Their duty is to float nearer to the observing machine and to come to grips with any enemy who appears on that level.

These are fast machines also, given to much circling about, that they may not outrun the slower machines below them.

At the height of a mile are the observing machines that "drag along" at perhaps eighty miles an hour. Their object is to find out what is happening on the ground below and to radio it to headquarters. If a big drive is on they must hold their position and spot the shots of their battery. The high flyers above must remain in position to protect them and keep the skies swept clear.

Still farther below, at a height of 1,000 feet, are the combat planes, which are different from the others. They attack the enemy of the ground. Carrying bombs in great number, they swoop down and scatter them among their foes. They also rake the enemy trenches with their machine guns and attack the advancing reinforcements, the line of transportation and the munition bases. They even deliver shells to men who are hard to reach, by releasing them in a parachute. They are a new force in actual fighting and are playing great havoc behind the enemy lines.

Bomb dropping is used more and more as the airplane is being perfected and put to much greater use. The Germans denounce this **BOMBING FROM THE SKY** practice of the Allied aviators as "baby killing" as hotly as England denounces the German slaughter of defenseless women and children. But the Germans first broke the laws of war by bombing unfortified towns, and even gloried in it. Bombing is becoming more and more accurate, although the "misses" still far outnumber the "hits."

One might think that it would be easy to wipe out a fort, to demolish a bridge, or blow up a battleship by dropping on it a hundred pounds of high explosive from an airplane. But one must remember that

the airplane is moving, perhaps a hundred miles an hour. From such a moving object it is difficult to hit a target. The fast-moving airplane, when releasing a bomb, gives it a forward motion. Then, too, the winds may deflect the bomb before it reaches the earth.

To hit a target from the air the flyer must know his height as well as his speed with almost impossible accuracy. If he hesitates even a few seconds in releasing the bomb it is carried beyond the target. A hunter in hitting flying game must aim ahead of his target. The difficulty is the same whether the target or the gun is moving. Aiming ahead causes all the trouble.

The resistance of air currents has a strong power on objects falling from a height. Then, too, the **STREAMLINE BOMBS** shape of the falling object must be considered. Balloonists sometimes throw empty bottles from their baskets and marvel at the crazy antics performed by the bottles and the length of time they take in reaching the ground. It is said to be the rather streamline form of the bottles that makes them dart about and thus delays their fall. They have no rudder to keep them headed in the one direction.

In order thus to defeat the air and make the bombs drop straight and quickly they are made in the shape of a torpedo or a huge cigar with tail planes on them. A tail has the same effect on a bomb as the tail feathers have on an arrow. Bombs are made in the streamline form so the air will interfere with their path as little as possible. The torpedo-shaped bomb turns its sharp nose against the wind and cleaves without allowing its direction to be changed. When the bombs are first set free they do not drop, but take the forward motion of the machine and for a time actually travel horizontally. Then they turn gradually and shoot for the earth. As soon as the

actual falling begins, the head dips, aided by the tail planes, and cuts a clean curve to the earth.

Bombs are dropped on the shotgun plan, that is, they are dropped half a dozen or more in rapid succession with the hope that one, at least, will **SHOTGUN** find the mark. By releasing them in quick **AIM** succession errors in judging altitude and speed are readily corrected, because the bombs are scattered along a line parallel with the path of the flyer. A dozen bombs may be aimed at a munitions factory. One perhaps hits its mark while the others are scattered over a residence district with terrible results. The opposing armies resorted more and more to the use of bombs in the later months of the war. Many tons were dropped each day.

To this point we have spoken of the actual flyers and their training. Behind them is another group **GROUND** of men of the air service, just as important **SERVICE** as the aviators. Airplanes must have mechanics who are of the highest skill. If the mechanic should make a very small mistake the flyer would probably lose his life, for the engine might stall over a wood where a landing was impossible and the airman would be in great danger. Much care is taken in choosing mechanics. When they are chosen they have special training in the factory and they get experience on the aviation field. They must be of the right type, must "make good," and must never fail the men they serve. For every machine in the air there must be two in reserve and each of the two machines has an additional engine. Behind these again are two training machines. British experience has shown that forty-six men are needed on the ground for every flyer. Thus you can see how great an army is necessary in order to put twenty-five hundred fighters in the air at one time.

CHAPTER III

CHASING A GERMAN FLYER

Dear Uncle Francis:

This is to wish you a Happy New Year, and to send you my best wishes from the front. I am **NIEUPORTS** located "somewhere in the Vosges," surrounded by hills, eight inches of snow, very cold weather, and Frenchmen. I am flying the little fighting Nieuport, a one-man machine with a fixed machine gun on its nose, synchronized to and firing through the whirling propeller. This airplane is next to the fastest machine which the French have, and the only one faster is the Spad fighting machine. The latter is the fastest machine of the war. I have also flown it, and soon this Escadrille is going to have them instead of Nieuports. The Nieuport makes about 120 miles per hour, while the Spad makes 140 miles per hour.

Recently I had my first skirmish, or my first introduction to the Hun birdman. It happened two days ago. I was flying in patrol, with a French pilot in another machine, about two miles over the trenches. Suddenly to my right and several thousand feet below I saw a French observation balloon go up in flames. We both dived down to the spot, for we knew it was a Boche airplane that must have done the work, and there we circled around looking for the Hun, whom we could not find.

As we did so, pretty little gray clouds began quickly forming all about our two machines, but **BURSTING** when these pretty little clouds began to **SHRAPNEL** grow larger, come nearer, and make a

noise perceptible above the noise of our engines, they did not seem so pretty. They were bursting shrapnel, fired at us from the enemy trenches. We immediately directed our machines in a zig-zag course, to spoil ourselves as a target for the shrapnel guns, and luckily neither of our machines was touched.

As I was zigzagging about like that I caught sight of the German airplane we had been looking for. I thereupon did a series of dips in front of the Frenchman's machine, to show him that I saw a Boche, and then started after him. Just then, however, the Frenchman got some engine trouble and had to glide back to our airdrome and land, so I chased the Hun alone.

I had the faster machine, but he had a head start of about a mile, and he was headed straight for **CHASING** Germany and his airdrome. I put on **THE BOCHE** "full steam," climbed my machine to five thousand meters, and maneuvered to get above the Boche, and between him and the sun, in order to have the advantage in case of a combat. I followed him for fifteen or twenty minutes, far over Hunland, but he would not turn to give battle. He had brought down the French balloon, and, feeling that a good day's work in itself, did not wish to risk more in a battle. He saw me coming, however, for his course was straight as a die towards his airdrome. I only hoped that I could catch up with him before he landed and thus force him to battle, but it was too late.

Just as I came into fair shooting distance and had emptied about 20 spent rounds of bullets at him, he dipped down, for he was in gliding distance of his airdrome, while I hovered around to see him land in the valley of the Rhine. I was disappointed to miss out so closely, merely by a matter of minutes,

or even seconds, at getting a chance at him, but having had only ten hours over the lines at that time it was probably the best for me.

Much love and best wishes for a Happy New Year,
from

ALAN WINSLOW.

CHAPTER IV

OUR FIRST AIR VICTORY

Lieuts. Alan F. Winslow and Douglas Campbell brought down the first two German airplanes to fall victims to the American aviators with the forces of General Pershing. The story is told at first hand by Lieutenant Winslow in his diary, which has been made public by the war department.

Lieutenants Winslow and Campbell were on emergency call on the morning of April 14th, 1918, **WINSLOW AND CAMPBELL** when at 8:45 information was received that two German machines were maneuvering above a city only a mile away from the airdrome. Both lieutenants at once took the air. The following is Winslow's story:

I had not made a complete half turn and was at about 250 meters when straight above and ahead of me in the mist of early morning, and not more than a hundred yards away, I saw a plane coming toward me with huge black crosses on the wings and tail.

I was so furious to see a German directly over our aviation field that I swore out loud and violently opened fire. At the same time, to avoid my bullets, he slipped into a left-hand reversement and came down, firing on me. I climbed, however, in a right-hand spiral and slipped off, coming down directly behind him and on his tail. Again I violently opened fire. I had him at a rare advantage, which was due to the greater speed and maneuverability of our wonderful machines. I fired twenty to thirty rounds at him and could see my tracers entering his machine.

Then, in another moment, his plane went straight

down in an uncontrolled nose dive. I had put his **ENEMY** engine out of commission. I followed in a **FALLS** straight dive, firing all the way. At about six hundred feet above the ground he tried to regain control of his machine, but could not, and he crashed to the earth. I darted down near him, made a sharp turn by the wreck, to make sure he was out of commission, then made a victorious swoop down over him, and climbed up again to see if Doug needed any help with the other Boche, for I had caught a glimpse of their combat out of the corner of my eye.

I rose to about 300 feet again to see Doug on the tail of his Boche. His tracer bullets were passing throughout the enemy plane. I climbed a little higher and was diving down on this second German and about to fire when I saw the German plane go up in flames and crash to earth. Doug had sent his German plane down one minute after I had shot down mine.

Mind you, the fight took place only 300 meters up, in full view of all on the ground and in the nearby town, and it took place directly above our aviation field.

When we landed only our respective mechanics were left in the drome. The whole camp was pouring out, flying by on foot, bicycles, side **WELCOME** cars, automobiles; soldiers, women, children, majors, colonels, French and American, all poured out of the city. In ten minutes several thousand people must have gathered. Doug and I congratulated each other, and my mechanic, no longer military, jumped up and down, waving his hat, pounding me on the back instead of saluting, and yelled: "That's the stuff, old kid!"

Then Campbell and I rushed to our respective German wrecks. On the way there—it was only a half a mile—I ran into a huge crowd of soldiers, blue and khaki, pressing about one man. I pushed

my way through the crowd and heard somebody triumphantly say to the surrounded man in French:

“There he is; now you will believe he is an American.”

I looked at the man—a scrawny, poorly clad little devil, dressed in a rotten German uniform. It was the Boche pilot of the machine I had shot down. Needless to say, I felt rather haughty to come face to face with my victim, now a prisoner, but did not know what to say. It seems he would not believe that an American officer had brought him down. He looked me all over and then asked me in good French if I was an American. When I answered “Yes” he had no more to say.

There was a huge crowd around the wrecked plane, and the first man I ran into was our Major—the commanding officer—and he was the happiest man in the world outside of myself and Doug. A French and American General blew up in a limousine to congratulate us—colonels, majors, all the pilots, all the French officers, mechanics, everybody in the town and camp. All had seen the fight.

Doug had set his Boche machine on fire at 300 meters and it had fallen in flames, rolling over three **CAMPBELL'S** times, and then completely burning up. **VICTORY** There remained but a charred wreckage, like the sacrifice of some huge animal. The Boche pilot had been thrown out and was badly off. His face, hands, feet, nostrils and lungs were all burned, while his leg was broken. He is now in the hospital and my Boche is probably commencing his job of ditch-digging for the rest of the war.

They got much valuable information from my man. He was a Pole; said he was not an officer because he was a Pole, although he had been an “aspirant” and a pilot at the front for two years. He said to me, with a sort of sigh of relief, throwing up his

hands at the same time, "Alors, la guerre est fini pour moi." ("Well, the war is over for me.")

That afternoon my wrecked Boche plane and the charred result of Doug's good work were exhibited in the public square of the town, surrounded by an armed guard and overlooked by a French military band. It also was a great day for the townspeople, and has had a good moral effect. You can imagine it when you realize it took place above their roof tops at only 300 meters, and that they were able to see the whole fight. The Americans are indeed welcome in the town now, and Doug and I can buy almost anything half price.

An amusing incident was this—the fight was so near to the earth that bullets were flying dangerously all about the ground. No one was hurt save a French worker in the field, who received a hole through his ear from one of my bullets and is very proud of it."

Both Winslow and Campbell were decorated by the French Government and were proposed for the American Distinguished Service Cross.

*See my World War, Chapter 9.

CHAPTER V

DEFEATING THE SUBMARINE*

About three months after the war opened, the German commander, Weighen, of the U-9, performed a noted exploit. In less than an hour he sank three British warships. A great panic arose among the British naval men. They did not know but that the submarine might sink the British fleet, or be the means of its final defeat.

But after three months the submarines did very little in battle with warships. In the naval fight off **U-BOATS VS. Helgoland**, British light cruisers fought **WARSHIPS** for six hours in waters that were fairly infested with German U-boats and came out unscathed so far as torpedoes were concerned. There were submarines with the German fleet in the Dogger Bank battle also. Evening twilight, which put an end to the battle, brought ideal conditions for torpedo attacks, but this did not enable the submarine boats to make a single hit.

The battleship has been sent to its station and it has been able to take its place in battle without harm from the submarine. This has been due to the screening devices. The great speed of the dreadnaughts, combined with the speedy powers of the destroyers, have made an effective defense. Battleships have even been saved after being seriously crippled, like the "Lion," which was able to limp slowly home after the Dogger Bank battle, possibly surrounded by destroyers.

It is fair to say that the submarine has proved deadly as a sea fighter in a single encounter, but as

See my World War, Chapter 15.

THE NEW BLOCKADE a part of a battle fleet it has proved disappointing. It has prevented men-of-war from proceeding leisurely back and forth off the enemy's coast, and it has prevented them also from lying at anchor near by. It has forced England to a distant blockade and compelled her to keep her fleet moving about, but it has not destroyed it.

The British cruisers and destroyers move back and forth in the North Sea at a rate of speed that a submarine cannot hope to match; and the blockade, instead of being close to shore, is usually hundreds of miles off the German coast. Still it is a true and effective blockade.

The work of patrolling the enemy's coast is now done by fast cruisers and destroyers, and by armed trawlers. These trawlers are slow, but they are too shallow in draft for the torpedo of the submarine to hit them. They mount a gun or two that outranges the guns of the U-boat, and they do a great service in fishing for mines.

There are several weaknesses of the submarine when it comes to fighting. It cannot carry heavy **U-BOAT WEAKNESS** guns nor sufficient armor to protect it from enemy fire, and it must come often to the surface to recharge its batteries. In fact, it must spend a large part of its time on the surface. It is also slow under water, moving from ten to fourteen knots at top speed, and can make only short spurts at that, on account of the quantity of fuel consumed in motion. On the surface, of course, it does better, obtaining a rate under full power of about eighteen knots. While this is too fast for the great bulk of merchantmen, it is no match for the men-of-war.

The submarine has done wonders in worming its way underneath the surface of the water through nets and under mine fields. The British "7" penetrated the Dardanelles, cruised as long as it wished

on the surface of the Sea of Marmora and paid a short but lively call on Constantinople. After it had cruised twenty-four days in Turkish waters, it wormed its way back to the fleet through a maze of nets and mines that were laid especially to trap it in the Dardanelles.

The Germans tried to use their submarines as blockade runners. They sent the *Deutschland*, a **U BLOCKADE RUNNERS** large submarine, with a wide radius of cruising, across the ocean to America; but its sister ship, the *Bremen*, never reached America, and no one knows what became of it. Even the *Deutschland* was later changed into a mine layer; so that as a blockade runner the submarine has proved a failure, since it cannot carry enough of a cargo to make it worth while.

So, after all, the submarine has accomplished comparatively little, except as a pirate. When the Germans turned pirates with their submarines, the fate of the war hung upon the finding of something to reach this under-sea dog.

At the very beginning of the war, the British established a highway for troop ships and supply **CHANNEL CANAL** ships across the channel. This highway, it is said, is protected on either side by a huge steel net reaching from the bottom of the channel to within a few fathoms of the surface. The meshes of these nets are nearly, but not quite, large enough to permit the passage of a submarine. The U-boats are thus caught in the meshes and the crews meet a fitting end by suffocation.

Airplanes dart back and forth overhead, nests of mines head off the route from the enemy, and destroyers act as patrols on either hand. Scarcely a ship or a man has been lost crossing the channel.

By a similar method, using heavy escorts of cruisers and destroyers, Canadian troop ships have made the long trip across from Halifax without loss. The

Germans succeeded in getting two or three of the American transports, but otherwise America's troops have gone to France by the hundreds of thousands without loss.

Great damage can be done to unprotected ships by a few U-boats. It is said that not more than twenty-**TORPEDO BOAT** five are operating at any one time in **DESTROYERS** British waters. When the United States declared war, the pirates were sinking so many merchant ships that if their success had continued much longer England, who depends upon her ocean trade, would have been brought to her knees. Fortunately the United States was able to send at once a squadron of destroyers, the very kind of vessels needed. Just how many, or how large a fleet was sent, it is not allowed to be known; but it was these American destroyers that turned the scale and saved the day.

The torpedo boat destroyer has proven very effective against the submarine, as it is both speedy and quick at maneuvering on the surface. The destroyer is the best weapon yet devised against the submarine, and after America entered the war all the Allied nations built these as rapidly as possible.

The presence of a submarine, even when well beneath the surface, can be easily detected from an **BOMBING** airplane, whose observers can see several fathoms directly downward into the water. The depth of the submarine is then estimated and it is destroyed by dropping a "depth-bomb." These can be so adjusted as to explode when subjected to a certain pressure. As the pressure of the water increases with the depth, the bomb is so adjusted, before dropping, as to explode when it reaches the level of the U-boat. The water transmits the force of the explosion in all directions, and the submarine, if one is near, has its sides caved in. Depth-bombs are also used by destroyers.

But the real answer to Germany's lawless use of the submarine was America's huge ship-building **AMERICA'S** program. In May, 1918, the tonnage of **ANSWER** new ships built was, for the first time since February, 1917, greater than that of ships destroyed by submarines. The invention by the United States of the "standardized" ship, whose parts, like those of automobiles, are made in quantities from fixed patterns and "assembled" at the ship yards, has still further increased the output of new vessels, and rendered impossible the success of the submarine campaign. Our navy officers, coming back from across the waters, now speak of the U-boat with a confident tone, as though it has been defeated. They believe if Germany cannot master the Allies on the sea, she will be defeated in the end by this sea power.

CHAPTER VI

THE STORY OF TWO U-BOATS

In 1916, before America entered the war, the German U-boat 53 came to America and touched at Newport, Rhode Island. It was in command of Captain Hans Rose, an affable gentleman, who made a pleasing impression upon American naval officers. This U-boat, after leaving Newport, sank half a dozen merchant ships off Nantucket and steamed for home, while American destroyers picked up the survivors.

For reasons of her own, Germany did not send the 53 back, but made her the flag ship of a flotilla of eight submarines for pirate work on the coasts of Europe, with Captain Rose the commander of the group. The fleet of submarines met in rendezvous every few days by wireless call from the commander.

The big submarine, 53, was at length captured in 1917 by a French destroyer and two mine sweepers.

U-BOAT 53 It was taken uninjured. Captain Hans **CAPTURED** Rose was made prisoner, but not until he had destroyed all his papers to prevent valuable secrets getting into enemy hands.

Valuable secrets, however, were found in the captured U-53. So important were they that an Allied naval conference was held in the port to which she was towed. French, British and American naval officers attended. When the submarine was seized and the French boarding party ascended into the hold they found the wireless equipment was intact. The wave length used by the Germans in wirelessness land stations and sister submarines was carefully noted. The log-book gave away the secrets that the

captain had tried to keep by destroying the papers.

The log explained that the U-53 was one of a double flotilla of eight submarines and the captain **ENEMY** was commander of the group. The log-**SECRETS** book also showed that this U-boat flotilla met in conference every few days. One of the American officers suggested that they lay a trap and summon the enemy boats to the captured U-boat, using German codes and signals. The enemy did not know their flag ship had been taken. The trap was set.

The Allies summoned the sister boats of the enemy to meet at a certain place. Meantime a fleet of British and American destroyers went into hiding near by. The other enemy submarines came willingly at the summons, and five of them were sunk by the Allied destroyers. This was the best day's hunt of the war for the pirate craft of Germany. Lloyd George startled the world by announcing the good news in Parliament.

The U-53, under another name, is now patrolling every day for the Allies. Other German submarines recognize her as of German make and often approach her without fear. The French commander of the old 53 is sure he has sunk two submarines and has hit several others.

The U C-12 is another German submarine with a romantic story. After Austria and Italy had declared war on each other, Italy had reason to suspect that the Germans, although they were outwardly friendly, were aiding the Austrians.

In June, 1915, the Italian mine sweepers which guarded one of the Italian naval bases on the **MINING A** Adriatic, came upon a barrier of twelve **NAVAL PORT** mines in the water that had been laid by the enemy. They were cleared away, but a little later another barrier of mines was found in much the same position. It was evident that the mines were placed there by an enemy submarine.

The Italians determined that the next attempt on the part of the submarine should result in her own destruction. They had to wait until the following spring, when the submarine ventured again into the waters of the naval base to do her deadly work. This time she did not make her escape unobserved, but fell a victim of the Italian mines that had been placed for her. A loud explosion announced to the Italians that their enemy was sunk.

The water in which the submarine met her fate was not very deep, and the commander of the Italian **RAISING** naval base had a brilliant idea. He would **THE UC-12** make an attempt to raise the sunken vessel. He hoped he could refit and repair her and use her in the Italian service. It was a desperate thing to attempt, for the commander knew she must have had a load of mines.

He sent down divers to see where the submarine lay and she was cautiously fished up to the surface. She was a broken, tangled mass, at first sight, quite useless.

When she came to the surface the Italians awoke to the perfidy of Germany. The U C-12 was of German make and her crew were German sailors. It was now clear that Germany was lending her submarines to aid Austria, while she pretended to remain on friendly terms with her old ally, Italy.

The log-book of the U C-12 showed that she made her trial trip on the Weser. Then she was towed through the Kiel Canal in 1915. Here she took on board the mines she was to sow in Italian waters. She was then sent in three pieces by rail from Kiel to Pola, where she arrived in July, 1915. Putting to sea here, she laid aside her German flag and took one from Austria. She was also provided with a British and French flag for all occasions. She had a Greek flag, too, so she might pose as a neutral. All these flags were found on the U C-12 when she was raised.

Between the times she was laying mines she was active in the Adriatic carrying cargoes of rifles or otherwise aiding Austria.

It took the Italian naval engineers many months to repair the U C-12, but it has been accomplished, and she now flies the tri-color emblem of Italy, Queen of the Adriatic.

CHAPTER VII

A BRITISH CAPTIVE ON A GERMAN "SUB"

The captain of a certain English merchant vessel was taken prisoner by the commander of a submarine after his vessel had been torpedoed and spent fifteen days on the U-boat. He tells the following story:

"My ship was torpedoed without warning. The force of the explosion was so great that the bridge was wrecked, and when I recovered from the shock I found the ship was sinking. None of the crew was injured and we were all able to get away in the boats.

"As we were in British waters and it was broad daylight, I did not fear that we would not soon reach **TAKEN** land, but hardly had we pulled clear of the **CAPTIVE** sinking ship than the U emerged. The commander summoned us to his vessel and ordered me to go on board. After asking for details of my ship and cargo, he told me to consider myself a prisoner and sent the boats away. I was at once taken below and the vessel dived.

"From what some English-speaking members of the crew told me, the submarine had been away from her base for some days. She was a fairly large craft, of recent numbering, having three torpedo tubes, two in the bows and one aft, and carrying ten torpedoes. She was also armed with a 4-inch gun just forward of the conning tower.

"I had arrived just in time for the mid-day meal: stew with stringy meat, which was probably horse **MEALS ON** flesh, small portions of sausage, and **A U-BOAT** black bread. This bread, as the voyage

progressed, became mildewed, and then some bread of lighter color which had been kept in an hermetically sealed receptacle was served out; but this was even more unpalatable than the black. The other meals were breakfast and supper at which coffee, made of burnt barley and acorns, was served. The commander and officers of the U-boat fared the same as the lower ratings, but were able to supplement their allowance with tinned ham.

“Life on board the submarine was by no means pleasant. Forced as we were to keep below the surface to avoid the British war vessels, **LIFE UNDER SEA** the boat sweated, and all spare clothing became saturated with moisture, while the atmosphere often became very foul and breathing difficult. While we were below surface the crew would switch on the talking machine. That was the band which played triumphantly when the U-boat got a victim. Sinking of an innocent merchantman caused that crew as much joy as if they had sunk a war vessel.

“While I was on board we had ‘victory music’ on seven occasions, for six steamers were torpedoed and one sailing vessel sunk by gunfire, thirty-nine shells being necessary to do this. The U-boat also attacked by gunfire several other steamers during the voyage, but had to submerge owing to intervention of British war vessels.

“On the third day I gathered that the U-boat was about to carry out an attack on a convoy which had been sighted. The boat approached **THE DEPTH BOMB** under water for some distance and torpedoed a large steamer. Our whereabouts were evidently detected, for we dived rapidly to a great depth. Hardly had the boat got on an even keel when we heard a tremendous explosion which caused the submarine to vibrate from stem to stern. It was a depth charge. The effect on the crew was

evident. All stood trembling, with faces blanched with fear, not attempting to speak a word, expecting a discharge. For some moments we waited.

"Engines were stopped and all means were taken to prevent giving away our position. Minutes seem like hours in such a situation. I must admit that I was turning over in my mind whether I should ever see my family again. No further explosions, however, took place, and after lying some eighteen fathoms deep for a long period we continued on our voyage.

"We had another experience with depth charges, or 'wasser bomben,' as the German sailors called **A CLOSE CALL** them. The sailing ship referred to above had just been sunk by shell fire, when two destroyers were sighted on the horizon, and down we went. By the microphones the propellers could be heard, and as the vessels came nearer we in the submarine could hear the thudding quite distinctly. To and fro the destroyers went, searching very carefully for us. Apparently they picked up a clew, for there were two loud explosions ahead quite near enough to cause the submarine first to tremble and then roll about as though in a heavy sea.

"Late the following night there was considerable rejoicing in the submarine. Germans had torpedoed an oil tanker, which, according to the commander, had sunk in thirty seconds. The next day we seemed to have got out of the track of steamers, and I went into the conning tower and saw the officers amusing themselves by shooting at gulls or at empty bottles.

"By this time the vessel had evidently reached the extreme outward point of her voyage, and on our return trip three Norwegian ships were stopped for fresh food. Just after this there was more excitement, due to the discovery that a British submarine was in our vicinity. The crew could hear her, and

they seemed in great fear lest she should attack. Again we remained submerged until night.

“The submarine was equipped with powerful wireless apparatus, and every day, about 9 p. m., re-
AMERICA maintained on the surface in wireless commu-
AT WAR nication with the base. One of the officers kept a record of these messages. One night the news arrived of the American declaration of war. It was eagerly discussed by the crew, some of whom expressed the hope that they would be allowed to go on submarine service in the Gulf of Mexico in order to escape the severity of the North Sea.

“In time we went into port and I was taken to a German prison camp from which I was exchanged and allowed to return to England.”

CHAPTER VIII

NAVAL DEFEAT IN THE DARDANELLES*

"About February 15, 1915," says a newspaper correspondent, "I arrived in Constantinople. It was being voiced about that the British and French were sending a large fleet into the Mediterranean for the purpose of forcing the Dardanelles and taking the Ottoman capital. How the news leaked through I do not know. The Turks and Germans got their information in Bucharest, but the news was later corroborated from Athens.

"Those were anxious days in Constantinople, while officials of the Ottoman government never tired of asserting that the Allied fleet could not get through. However, certain German naval men, whose acquaintance I made, were not so confident. It seemed to be entirely a question of ammunition.

"No ammunition could get through from Germany unless it passed through Roumania. Rumors were afloat that some of the Roumanian officials were not strictly honest; that through their neglect or dishonesty, armor-piercing shells were reaching the Turks. Later events proved these rumors false, but the Allied fleet commanders believed these rumors and thus failed to renew their attacks at the critical time.

"The Allied fleet attacked the Dardanelles in earnest in March, 1915. The Turkish shore batteries **THE** at the entrance to the Strait were silenced **ATTACK** by tremendous expenditure of ammunition, and after the batteries along the outer Dardanelles were reduced, the Allied fleet entered the Strait. The

*See my World War, Chapter 11.

chief performance here occurred on March 18th. Two shells from the super-dreadnaught, Queen Elizabeth, began the event at 11:20 sharp. While the debris of several houses was coming back to earth, I was making off in the hope of finding some shelter under the parapets of the fort.

“For awhile the protection seemed ample. By noon it seemed not so ample and once more I **SHIPS** treated. About one o’clock the fire of the **vs. FORTS** Allied fleet reached its maximum intensity. Out in the bay lay nineteen ships, and some thirty cruisers and other craft, and they were pumping shells into the Turkish fort at the rate of five every minute. It was one of the great days of the war; in one respect, the greatest. Never before had so large a fleet tried issues with coast batteries. The crash of artillery was frightful; houses collapsed as the result of the tremors.

“By noon some of the surrounding towns were in flames. The shells from the Allied guns threw up more earth gushers in and near the forts. Out on the bay rose the water spouts caused by the Turkish blueheads. Now and then the roar of artillery made it impossible, for a minute at a time, to hear a word spoken directly into the ear, and even the leather-lunged Turkish and German officers had difficulty in making themselves understood to their crews, despite the use of large megaphones.

“Out on the Allied ships the gunners were serving guns as fast as they could be served. Volley came upon volley, crash upon crash, and above this din rang the stentorian ‘Fire!’ of the officers of the Turkish batteries. For two hours this chaos reigned.

“The large ships had so far given the shells of the Turk a wide berth, but that led to a waste of **AT LONG** ammunition and of time. Gradually the **RANGE** two circles formed by the fleet enlarged,

bringing the ships nearer. With splendid recklessness the 'Bouvet,' one of the French ships of the line, came in closer. As the Bouvet swung around at the nearest point four shafts of flame issued from behind the parapet, and four shells sped toward the Bouvet. One of them raised a huge waterspout near the stern of the vessel. A red sheath of sparks leaped up and disappeared almost instantly as the particles of steel cooled. In the next instant a tremendous cloud of smoke, steam, and water arose from the body of the ship; a second later she showed a heavy list. More shells were being rammed into the guns. The Bouvet was no longer moving. With a lurch to one side she disappeared under the surface at exactly two o'clock by our watch.

"There was a lull everywhere as men jumped out on the parapet to see the first of the day's victims **BOUVET** go down. Then a mighty chorus of shouts **SINKS** sped over the waters of the Dardanelles and reverberated in the hills. During the short pause an attempt was made to save the few men whom the ship had not taken down in her plunge. So far as I could see, a dozen were swimming in the water. From the British ship which had hurried to the scene when the Bouvet was first struck, some small boats put out and moving around in the water, looked like things of burnished silver. How many men were picked up I do not know. I should say that if six or seven were saved from the complement of about two hundred souls, the number is high.

"The day wore on. The Bouvet had made the Allied commander more cautious. He kept his ships out of range, so far as the Turkish shore guns were concerned, but did not have that choice with regard to the howitzers which the Turks had stationed on the hills. These guns kept pounding the decks of the British and French vessels and by four o'clock

they had done much damage. The 'Queen Elizabeth,' the terror of the Dardanelles contingent, had been put out of action. The 'Irresistible,' 'Ocean,' and 'Inflexible,' and two others which I could not identify, were being made into helpless playthings of the current in the strait. From the 'Irresistible' and 'Ocean,' the crews were being taken off. The other ships were being towed back to the entrance of the Dardanelles and away from the pest of the high-angled guns in the hills.

"The 'Irresistible' had the bad luck to get into the counter-current of the straits that sweeps north-**BRITISH** ward along the shore. The speed of the **LOSSES** water is not very great, but it made futile all efforts on the part of the British to get the vessel out of the danger zone into which she was drifting. Before a few minutes had passed the 'Irresistible' had drifted into range of one of the forts. Of twenty-five shells fired by the Turks nineteen took effect and the vessel sank, taking with her the remainder of the crew into the deep. The 'Ocean' meanwhile had been towed into the bay, but she leaked so much that all efforts to save her were frustrated and she, too, sank in deep water.

"There is no doubt that the day was against the Allied fleet. The total casualties in killed and wounded were not more than a hundred among the Turks and only one gun had been put out of action while three others were slightly damaged. Yet there was gloom among the Turks and I suspected the reason was a lack of shells, but had no confirmation until about midnight, when I asked one of the Turkish commanders, 'What is the outlook for tomorrow?' 'Not so very good,' he replied.

" 'Not so very good?'

" 'No.'

" 'What's the matter?'

" 'That I cannot tell you,' replied the officer, 'but

at any rate if the enemy fleet returns tomorrow it **SHORT OF** will go badly with us. They have lost **SHELLS** heavily today to be sure, but I know the British well enough to know that they will be back here bright and early tomorrow. If you have anything around here that you wish to save, I would advise you to get out of here early in the morning.'

"Another officer told me that it had been decided that if the Allied fleet returned in the morning the coast batteries were to hold out until the last shell and then the crews were to take to the hills. That very night the archives and the treasures of the Sultan and the Ottoman government were being packed, and during the succeeding day they were to be taken to the ancient capital. The Sultan and the government would go over there during the night of March 19th. If the Allied fleet came back in the morning then this would be necessary, for the reason that the British warships would lie before Constantinople by sunset of the 20th.

"Everybody expected the British fleet to return, but it did not. Had the Allies known how little **THE** ammunition the Turks had left in the **RESULTS** Dardanelles forts, they would doubtless have returned the next day and captured Constantinople."

The European war might now be a thing of the past, if the Allies had followed up their successes at the Dardanelles. With Constantinople in the hands of the British, Bulgaria would never have dared to range herself on the side of the Central Powers. In that event, the entire Balkan Peninsula would have formed a solid Allied block. With that achieved, the war would have been ended. The failure of the Dardanelles operations caused not alone the destruction of Serbia and Roumania, but also prevented the development of the full military power of Russia.

CHAPTER IX

CAMOUFLAGE ON LAND AND SEA

Because of the accuracy of the long range guns and the keen eyes of airplanes it has been found necessary to protect men and guns by every device known. This art of concealment is known as camouflage, and it has reached a remarkable degree of development.

The artist, called camoufleur, resorted to nature for his first lessons. The tawny lion and striped **NATURE'S** tiger resemble the tall yellow bunch grass **TEACHING** of the jungle. The giraffe is clothed with a quaint diamond pattern exactly like the flickering lights among the acacia trees on which it feeds. The leopard, the jaguar and all spotted cats, the spotted deer and the dappled horse are colored to imitate light under a shady tree. The elephant has developed a hazy brown like the great trees of the deepest forest. Thus many animals, birds and insects are colored by nature for concealment in their natural landscape. Many of them change their clothes with the seasons, wearing white for the snowy winters and brown for the torrid summers to protect them from their enemies.

In exactly the same way the great armies have been forced to seek shelter. The khaki blends perfectly with the grasses and timber of temperate regions. The German field-gray is a good imitation of the shadows cast by woods or entrenchments on a sunny day and blends very nicely either with rain or fog. The horizon blue of the French armies tones well into the average landscape.

An army of today when ordered to "stand fast" is almost invisible at a half mile.

In the early part of the war the British made one mistake. The service cap was kept taut with a wire hoop inside the rim of its flat top. The top, so stretched, reflected sunlight and offered a fine target for enemy marksmen. This was soon discovered and the wire was removed.

Strong and irregular coloring breaks the outline of any object; so not only tents but wagon covers **STRONG** and huts are made to look like the patched **COLORS** and rough ground of camps and roadways.

The bell-shaped tents, formerly used, were visible at a distance of several miles and made perfect targets for heavy artillery. Now all of them are painted with patches of different colors, the bolder, the better.

When the German airplane observers get a peep at our lines the things that they think they see, are not there at all, while the guns that they can neither see nor photograph are all the while pounding the enemy trenches.

Camouflage is accomplished in many ways, by painting, by screens, by boughs of trees, by wisps of raffia tied in a net, like that on a tennis court. Stacks of ammunition, garages, batteries and roadways are screened by canvas, painted like the ground, so that they cannot be discovered by an aviator. Sometimes motor trucks and guns on the road are covered with leafy boughs or layers of hay. Everything is camouflaged. Nowhere do you see a long gun thrusting its black snout through the green bushes or trees.

On one occasion it was necessary to move a French division through a certain village. At one **PAINTED** point a cross street opened directly toward **CANVAS** the German lines. A strip of canvas was painted by the camoufleurs with an exact reproduc-

tion of the background seen by looking down this street. This canvas was stretched across the street by night on the German side of the highway, and the entire French division passed behind it without being detected by the enemy.

In the "No Man's Land" between the trenches on one occasion lay a dead horse. The French cam-
A PAPER oufleurs prepared an exact duplicate of it
HORSE in *papier mache*. One dark night a scouting party removed the dead animal and substituted the imitation, first digging under it a shallow pit. In this pit they placed an observer, who for several days watched the German trenches through small peep-holes cut in the *papier mache* shell, and reported what he saw through a telephone wire communicating with headquarters.

It is a simple thing to cloak a gun on land, by using a screen of bushes or foliage, or by mottling
CONCEALING it with paint so that its contour, or out-
A SHIP line, disappears. But the ship, afloat, cannot easily disguise itself, except by a smoke screen. Even when painted a single tone of gray it can be seen rather distinctly with the sky as a background.

Atmospheric gray and paint-brush gray are two very different things so far as our ability to see them is concerned. Paint-brush gray is obtained by mixing black and white pigments, while atmospheric gray is a vibratory effect resulting from the mingling of red, green and violet rays of light. The quality of this gray changes from hour to hour as one or another of these light rays predominates. No single paint color could adjust itself to these changes.

The U-boat commander, in order to launch his torpedo with a fair chance of hitting the target,
"SUB" AIMS must know how far off the enemy ship
AHEAD is, and whether her course is bringing

her closer or taking her away. He must know, too, about how fast she is moving. With these factors fairly gauged he must direct the torpedo far enough ahead of the moving target to allow for the time of flight and for the advance of the enemy ship. It is the same problem as that of the duck hunter, who must estimate the speed and direction of flight and shoot far enough ahead to allow for them.

Merchantmen are now armed with fairly heavy guns and these drive the U-boats to cover beneath the surface. The submarine commander must then keep track of his moving target by means of a periscope, which is a poor substitute for the naked eye or for the binocular vision provided by good field glasses. The periscope is one-eyed, which makes it very difficult to estimate distance.

Upon the field of the periscope there are a number of horizontal and vertical lines. The horizontal lines are spaced to show the height of a ship at distances of 1,000, 2,000, and 3,000 yards. By these the observer estimates the distance or range of the enemy vessel. The vertical lines are spaced to show time intervals at those different distances so as to determine the speed of the vessel passing across them.

The camoufleur, therefore, so disguises his ship as to deceive the U-boat captain as to distance. In **CONCEALING A SHIP'S HEIGHT** order to estimate distance the commander of the submarine must be able to measure the height of the enemy ship from her true water line to the top of her smokestack. This is a reasonably constant figure among freighters and may be pretty closely estimated in cases of other larger merchant ships and well-known types of naval vessels. Any coloring that will tend to obliterate the actual water line or conceal or confuse the top of a steamer's smokestack will defeat the observer in the U-boat in his endeavor to determine

the distance or range of his target. The water line is often concealed by painting the sides of the ship with stripes in wavy lines to look like the surface of the sea. Another device is to "paint off" the stern or paint part of the smokestacks white to make them appear short and farther away. This will throw the U-boat gunner out in calculating how far ahead to launch his torpedo.

The camoufleur also paints his ship so as to disguise her outline. The usual lighter portions are **DISGUISED** toned down and dull portions are **ITS OUTLINE** thrown up by painting them in bright colors. The light and shade on the hull, funnels, and other parts of the vessel are reversed, thereby confusing the observer both as to the length of the ship and the angle of her approach or departure. Some ships are painted to appear as though they were sinking. Others have the hull of a smaller vessel painted upon their side. Sometimes they paint their ships with great splotches of strong pink, blue and green. One or another of these colors becomes prominent in different qualities of light and thus conceals the form of the vessel.

It is known that the eye tires in a minute or two in looking through a periscope even in broad daylight, and that such fatigue causes errors in judging both speed and range. Marine camouflage is so planned that it will more quickly tire and bewilder the observer, and thus defeat his aim.

CHAPTER X

FIGHTING WITH POISON GAS

The Germans began a new horror of warfare when they introduced the use of poisonous gas. The use **GERMANY USES GAS** of poison in war in any form was outlawed by all civilized nations centuries ago as being too cruel and barbarous for fair fighting; but Germany broke over this rule as she did all other civilized rules of warfare. The first gas attack was made in April, 1916, and the whole course of the war was changed.*

A deserter had come into the Allied trenches a week before the attack and told the Allies the whole story. He said that the Germans were preparing to poison the English with gas and that they had cylinders full of it installed in their trenches. No one believed him and no notice was taken of his story.

The first attack, therefore, was made against men who were entirely unprepared for it. The Germans almost broke through the line of the Allies before Ypres. It was saved only by the heroic soldiers of Canada, who extended their line to fill up the gap and held it for several days till reinforcements came. We do not know all of the story, because the men who could have told us most about it did not come back. The Germans claimed that the Allies lost six thousand men killed and as many more prisoners.

When Germany released the first wave of poison gas it is said that the British general in command **BRITISH IN PERIL** wired London that if some protection were not provided within three days the whole British line would be compelled to retire. Within

*See World War, Chapter 12.

thirty-six hours a million and a half gas-masks were made by heroic efforts and delivered at the front. They were simple gauze affairs containing some chemical to kill the effect of the dread chlorine gas which was used by the enemy.

When the Germans first began to use gas, they adopted a fairly simple method, but it required **THE GAS WAVE** some preparation beforehand. A hole was dug in the bottom of the trench close underneath the parapet and a cylinder of compressed gas was buried in the hole. It was an ordinary cylinder like that used for oxygen or hydrogen. The cylinder was first covered with a quilt of moss, and then with sand bags. When the attack was made the sand bags and protecting cover were taken off the cylinder and each cylinder was connected with a lead pipe, which was bent over the top of the parapet. The sand bag was laid on the nozzle to prevent the back kick of the outrushing gas from throwing the pipe into the trench.

In all these first attacks chlorine was the gas employed. This is heavier than air and can be used **CHLORINE GAS** only when the enemy has a lower position, because it flows down hill like water. It produces intense irritation of the throat and lungs, and even when not fatal, incapacitates the victim for days or weeks. A successful attack, by the method described above, can be made only when the wind is blowing toward the enemy, and on several occasions the wind is known to have changed and carried the gas back to the people that set it free. To avoid this danger the Germans have almost abandoned the use of the gas cloud and have substituted gas shells.

These shells are now the most important of all methods of gas fighting on the western front, and they are still being developed. The quantity of gas that can be sent over in a shell is not more than six

pounds, whereas the German gas cylinders contained forty pounds of gas. To put the same amount of gas as with gas clouds on a wide front, say in five minutes, requires an enormous number of shells.

There is, however, a threefold advantage in the use of gas shells. The user is not dependent upon the winds; he can use the ordinary **USE OF GAS SHELLS** guns and not have to put in special apparatus in front trenches where they are in the way, and he can pick his target with all the accuracy of artillery fire. Moreover, the gas shells can reach targets that could not be reached with direct high explosives, for the gas will sink into a pit where a gun is being fired even when the gun has overhead covering. The crew of the gun must go on firing with gas masks on. When some of their number have been killed the task of the smaller number left behind working in masks is very trying. With gas shells one may reach dugouts just beyond the crest of a hill, or sunken roads on the further slope. This cannot be done with direct shells. Gas sinks rapidly into a dugout, especially if it has two or more doors.

The first shells were filled with what is known as "tear gas," because they made the enemies' eyes **GAS MASKS** water profusely and forced the men to take time to wipe the tears away or fight half blinded. The aim now is to use poison in the shells that will kill as well as annoy. After the first attack the British quickly developed an excellent mask and helmet. The gas masks have proved a success. Up to the present there has been no gas brought out on either side that can be depended upon to go through the enemy's masks. Chlorine is still much used both for gas waves and in shells charged with liquefied gas under high pressure. The manufacture of chlorine on a very large scale speedily became one of the great munition industries of the United States.

Even more terrible than chlorine is phosgene, which is a combination of chlorine with that other **NEW POISON GASES** deadly gas, carbon monoxide. This latter is produced in a coal or charcoal stove when the glowing coal cannot get a sufficient supply of air for complete combustion. Phosgene is heavier than chlorine and was often used for the gas wave attack under the favor of the winds.

The chlorine gas wave could be seen and gave the enemy time to don masks. The Germans finally used an invisible, odorless gas which could not be detected for two hours. As there was no odor the troops attacked could not tell they had been gassed until it was too late. The gas shells and the explosive shells came over in such great numbers that it seemed impossible to distinguish one from the other. There is, however, a difference in the sound of the explosions, which soon enables one to tell them apart.

Since the Germans began using "mustard" gas in 1917, it has been of all their gases the most employed against the Allied soldiers. It seldom kills outright, but it seriously affects the skin and membranes, inflicting the most painful burns and putting the men out of service for three months. Its great value lies in the fact that mustard gas is heavier than the others and will lie in the woods or valleys or shell holes for days at a time, while the other gases float away.

Mustard gas is a powerful producer of tears. After several hours the eyes begin to swell and blister, causing intense pain. The nose discharges freely and severe coughing and vomiting ensue.

Direct contact with the spray causes blistering of the skin, and the vapor penetrates through the clothing. The symptoms are similar to pneumonia—high fever, heavy breathing and often stupor. Gas masks, of course, do not protect against this.

The damage done by mustard gas is of slow and insidious development, the height being reached from five to ten days after the burn is received. Healing is slow. It is deadly poison to the lungs; a single whiff of it will cause agonized coughing and gasping for breath. These spasms may continue for days and they leave the lungs so raw that pneumonia or tuberculosis is likely to follow. A strong dose is more quickly fatal. There is perhaps not a more cruel and painful death than that by gas.

Mustard gas is employed in shells of all calibers up to eight inches. In one recent attack lasting forty-eight hours, the Germans used 7,000 tons of it. At Armentieres the gutters ran with the horrible reddish-brown liquid. It has killed men as far back as twelve miles from the front.

Mustard gas, besides being used in direct attack, is also used for "neutralization." For instance, where supplies and ammunition are being brought up, a few mustard gas shells will result in dangerous confusion and delay. A part of the infantry is "neutralized" by having food and ammunition cut down. If the shell hurts as well as neutralizes, so much the better.

President Wilson declared at first that he would not use gas. He thought it to be too horrible a way of fighting. But the Germans kept inventing deadlier types of gas, which they were using against the Americans. No matter how much we dislike this kind of warfare, we had to begin to use gas to protect our men.

The first gas attacks on American soldiers resulted in several deaths. Sixty-seven of our men inhaled the poisonous fumes. Five died before daylight came; some of the others were kept alive by oxygen. Sixty-one were treated in the hospitals,

where their agony caused the surgeons to curse the Kaiser and all his fiendish work.

The American mask to fight mustard gas is of the box respirator type. The hood is of rubber. Breathing is through the mouth, pincers shutting off the nostrils. The gas-charged air enters through the bottom of the canisters, where by means of neutralizing chemicals it is purified. From the top of the canister the air is drawn into the lungs. There is a one-way shutter valve in the hood through which the air comes out. This mask is designed to last ten hours. For artillerymen the War Department has made an oil suit which incloses the soldier bodily.

The deaths now are usually due to surprise or to the lack of training in the use of masks. Our soldiers are trained to use gas masks here in home camps. The mask must be put on and adjusted within six seconds. This requires a considerable amount of training to be done under field conditions.

Dug-outs are protected from gases heavier than air by curtains of burlap hung at the doors and kept **DUG-OUTS** wet with absorbent liquids. Mustard **PROTECTED** gas is removed from trenches and shell holes by means of great shovels made of canvas. These are found to work even better than fans.

The nature of the various gases used by the Germans has been discovered by examining shells which failed to explode. Soon after the Germans started to use mustard gas, Allied chemists found out how it was made and produced it. But for a long time the Allied forces at the front did not have mustard gas to use, for, while the Allied chemists could produce it in the laboratories, they could not produce it in large quantities.

Finally a method was found and the Allied armies were supplied with mustard gas for use against the

Germans. It is said that in our first gas attack upon the Germans they lost five hundred men, for they were unprepared for this gas. They had then to work out devices to protect their soldiers from this horrible stuff. There is a rubber famine in Germany and this has made many problems more difficult for them. So fatal were the gases used that finally army horses and mules, Red Cross dogs and even carrier pigeons had to be fitted with gas masks.

CHAPTER XI

HOW CHEMISTS AID THE FIGHTERS

In this war science has been used as never before. Germany, having been for many years the leader in matters of science, expected by the use of her great chemists to bring a speedy victory. The Allies, however, have kept close on her heels and in many cases taken the lead in new discoveries. Many wonderful secrets on both sides that have aided in the struggle and that will bring blessings to mankind in the centuries to come, will not be known till the war is over.

But much that science has done we are allowed to know about. Medicine is doing wonders in protecting the millions of men in arms against disease in camps and trenches. In previous wars more men fell victims of disease than fell on the battlefields. Even more wonderful than preventing disease is the record in saving life and limb from the carnage of the terrible battle front. Without the aid of chemistry the supply of medicine would have fallen woefully short.

In the early stages of the war there was much suffering in the base hospitals because of the shortage of drugs that deaden pain. Here, too, the chemists made new discoveries. Early in the war cocaine was much used to destroy pain, but it proved dangerously poisonous and caused many deaths. Moreover, the supply was limited and its cost was prohibitive for all but the wealthy. Chemists made a profound study of the arrangement of the atoms in the molecule of cocaine and gave the world the secret

for making similar but simpler drugs, which can now be made in any quantity from coal-tar products. One of the best of these drugs is called procaine, which is only one-sixth as poisonous as cocaine, and can be used without danger. Many other new drugs have been produced by the chemists since the war began.

Modern armies and fleets on the sea and in the air must have strong aids to the eye. When America entered the war one of many serious problems confronting us was the problem of securing optical glass. Upon this depends the keenness of vision of the modern range finders, of telescopes, field glasses and cameras. Our navy was growing tremendously and needed good "eyes" to spot the submarines. Our supply of this optical glass had formerly come from Germany and we had so little of it that our navy was borrowing from citizens all the fine field-glasses available.

Optical glasses of the purest quality depend upon the chemist, and our chemists went to the task. A very brilliant and rapid solution of the problem was worked out by a staff of American chemists under the able direction of Dr. Arthur L. Day. It is one of our great achievements in this war.

In making the airplane with its load of engine, armor, ammunition and pilot, the chemists were again summoned, because alloys were needed to combine with steel and other metals in order to obtain the greatest strength and toughness with the least possible weight. Chemists tested all the elements that go to make up an airplane—its resistance to the moisture of the clouds and the frigidity of the skies. They tested the fuel of the engine, the lubricant oils, the metal of the engine and framework, the material of the wings and of their coating. These are all prob-

lems of chemistry, and investigators are still at work on them seeking improvement.

As with the airplane, so with the submarine. We are almost sorry the men of science were so successful in working out problems of the U-boat, because of the cruel and lawless ways in which it has been used by our enemies. The men of science learned how to store oxygen for the men to breathe, they devised ways of absorbing the foul gases breathed out by the crew so they would not suffocate. They made electric storage batteries to propel the craft while under water. There were many other such problems to be solved.

Then there was the problem of supplying our country with substitutes for the chemicals that we had been importing from abroad. We needed drugs for the health of our people at home and for our army and navy. Almost all the essential drugs are now being manufactured in the United States. Some of them are superior even to the original German brand and are sold at a lower price to our people. Our chemists are all the time searching to discover new and, if possible, better remedies than those made under foreign patents.

All dyes for coloring clothing, leather and the like, came from Germany before the war. This supply **AMERICAN DYES** was cut off in 1914 by the British fleet, which drove all German commerce from the sea. It looked for a time as though we should have to be contented with white clothing. But our chemists set themselves to the task and were successful. It begins to look as though Germany has lost for all time the bulk of her dye-trade with us, for we are now making the blues and blacks and other plain colors in as good quality as those we were getting from Germany. In 1914 we had only six factories making dyes. Now we have nearly a hundred, with as many more building. The dye industry here

will probably need a tariff protection for a time after the war.

The mammoth steel industry is our greatest chemical industry, for it is a series of chemical operations **CHEMISTRY OF STEEL** carried out on a huge scale. The chemist is relied upon to show how to make the steel tough, or hard, or elastic, and how to temper it so it will resist heat or cold by mixing with it other components. He must show how to make guns with a longer life, how to make armor stronger, how to preserve the cutting edge of high-speed tools working at temperatures at which ordinary steel would melt like butter on a July day. All the way from the assaying of the ore at the mouth of the mine through the many steps until finished steel is made, many specimens are drawn off and sent to the chemical laboratory for rapid tests.

Side by side with steel stand the explosives for the millions of shells for the firing line. From toluene, a coal tar product, with the aid of nitric and sulphuric acids, many tons of the deadly trinitrotoluol or "T. N. T." are made daily. The power of this explosive was never shown in a more tragic manner than by the recent destruction of the city of Halifax. This calamity was brought about by the explosion of a cargo of "T. N. T." in the harbor.

Other high power explosives, such as picric acid, gun cotton, and dynamite, are being manufactured here on a colossal scale under the direction of expert chemists. If the process goes a bit fast, or gets too hot, man loses control of the giant powers and must flee to escape the volcanic upheaval.

These explosives, we are told, contain huge quantities of electricity ready to leap from atom to atom like a flash, and when they explode they produce enormous amounts of gases that can in a breath destroy cities or remove hills by their quick expansion.

The manufacture of sulphuric acid needed for explosives is in itself a vast industry, working at its **HIGH** utmost capacity and seeking sulphur **EXPLOSIVES** from every available source. For the nitric acid we are still dependent on the nitrates of Chile and Peru, but in August, 1917, our government began the erection of plants for the production of nitric acid from the atmosphere like those of Germany.

It may be that the war will be decided in favor of the nation that can hurl against the enemy the greater number of thousands of tons of "T. N. T." or some other dreadful explosive.

CHAPTER XII

AMERICAN TROOPS IN LONDON

(From the London Press)

"It was such a day as might have been in August, 1914, had our troops been permitted to march the **LONDON AND THE "YANKS"** streets in sunlight. To their mysterious and appointed end they stole away in the lonely darkness of night, and no voice cheered them and no hand held theirs in greeting or farewell. Since then the official mind has learnt to think a little differently—a little more sympathetically, perhaps. So it was given to us to greet America as we might have greeted the British soldiers, and all our hidden pride and restrained enthusiasm burst forth yesterday and were offered freely to the American soldiers whom we surely may also call 'ours.'

If they were not ours before, they became ours yesterday. We adopted them; they became something more to us than soldiers. In those hours of great cheering a sense of intimate kinship was born that will outlast the agonies of war.

It was not, in the superficial meaning, a picturesque procession. But it was intensely moving, very inspiring, and there could be no greater message of cheer and consolation in time of war-weariness than the message in the eyes and in the gait of every American soldier who passed through our city yesterday. That message was, "we mean to see it through."

Very early in the morning people discovered their viewpoints and waited patiently, watching the enor-

LONDON'S mous crowds that joined them. Traffic **HOLIDAY** was diverted or stopped altogether. Shops were shut and business was suspended. And later the meeting of the War Cabinet itself was adjourned so that the Prime Minister and his colleagues might become as the people of the streets, making greeting to the men who "meant to see it through."

Mounted police headed the procession. Following was the band of Life Guards—and then came the Americans. Londoners are not very ready to cheer. Theirs is the way of silent tribute. But yesterday they forgot the silly traditions of British reserve. They might have been Irish or Italian in their wild enthusiasm. For, as the first Americans were seen, cheers were raised such as never before have been heard in London.

Along the roadway, strewn with petals of roses flung by women, the Americans marched. In the distance they looked a little like Australians. They wore the familiar slouch hat tied with red cord, and canvas gaiters, and they carried their rifles with all the neatness of the experienced campaigner.

Stern, grave of face they were, looking straight ahead, as if conscious of the stupendous importance of their mission. It seemed, indeed, as if to them this was as much the road to war as the shell-broken dusty highways of France.

Louder and still louder rose the cries as the Stars and Stripes came in view. Soldiers in the crowd saluted; men raised their hats, and women threw their flowers and waved their handkerchiefs—and some of them sobbed happy tears of pride such as no man or woman need remember with shame.

At intervals passed the bands of Grenadier Guards, the Irish Guards, with their kilted pipers; the Welsh and the Scotch Guards, while flag-bearers with the Stars and Stripes, and in one instance with

the regimental color of the unit to which most men belonged, headed detachments.

You could not discover an American "type." Most of the men were clean shaven, finely-built and **AMERICAN** straight of limb. But all the races which **TYPE** make the nation such a delightful and in some ways such a complex race were there. There were men of Irish ancestry, and there were men whose fathers, in the long time ago, came from Germany. Today, of course, they are Americans, and Americans of the most undoubted loyalty. But the faces of the men in the great procession were very different and did not approximate to any given type, and it was deeply interesting to see the varying characteristics that have built up today's America.

With precise, determined step the troops swung along Piccadilly to Hyde Park Corner and curled around Grosvenor-gardens. And still the men shouted hoarsely and still little children waved their small flags, and still women cried "God bless you" and "Good luck."

Outside the American embassy in Grosvenor-gardens the crowd was enormous. But no halt was made, and there were no speeches. The American ambassador, Mr. Page, took the salute as his countrymen passed, and standing by him were Mrs. Page, Admiral Sims and members of the embassy staff. From the Maple Leaf Club close by, the Canadians showed what a Canadian cheer can be.

Then the Americans went onward to Buckingham Palace to march by the King of a people as free as those of the great republic, and to hear the greatest cheer ever raised in London.

Crowds stretched far down the Mall. People climbed on to the Victoria Memorial and the police **CROWDS** had orders not to interfere. Most of the **CHEERING** crowd could see little but the rifle points glittering in the sunlight. But they could hear the

tread of the soldiers, and no band ever made sweeter music for them. These cheering men and women could not see the King, who with Queen Mary stood in the courtyard, but they knew His Majesty was there. The most colorless life had its moment of radiant glory when the first Americans passed the King. The Guard of Honor had played the national anthem, and after the sudden silence cheers passed like a wave from the palace to the Admiralty Arch. In field-marshal's uniform, the King saluted each section as it passed, and those who were near him saw the pride in his eye, and the smiles as he talked, a little later, to Mr. Lloyd-George.

In the Green Park the troops were allowed a brief rest, and after they had joined in the general cheers for His Majesty they had some refreshment and made their way to Waterloo Station.

And here they came to the final stage in the journey so far as the public was concerned, and perhaps that is why there was an emotion such as is rare in England. For Waterloo to so many of us is a living place of mystery and pain, and of the most joyful home-comings. But we have had to hide our emotions, and there had been no bands and no great cheers to help our soldiers. From all the stations whence men have set off to the wars it has been in silence and in darkness.

But yesterday it was splendidly different. The bands were there, making great music with the American national airs. The station was crammed with people. Before the soldiers entrained, women from the station canteen showered cigarettes on them, and hurried along with trays of fruit.

Although no one was allowed on the departure platform, hundreds of people bought penny tickets, **AT THE** which gave them admission to the platform **STATION** on the other side of the train, and then be-

gan the most charming friendliness between the soldiers and civilians.

It was not at all in order, of course, but people darted on to the railway line for the remembered joy of shaking hands with an American soldier, and the men themselves clambered down and, like school boys, held out their hands and distributed visiting cards. They read quaintly to English eyes: "Corporal Geo. R. Barnaske, Company D., U. S. A., with Expeditionary Forces, in care of Adjutant General." This is the inscription on one card, and there was a little flag in the corner.

How everyone shouted for one of these cards. Small boys were dispatched on to the line and told to bring some back, and there was frantic cheering when the men themselves clambered down and cried:

"Write to us, won't you—and we will answer sure."

So hundreds of these military visiting cards were pocketed, and some of the friendships begun so curiously on a railway line will perhaps develop as the days pass by.

Before one of the trains steamed away the massed bands played the national anthem. Not a train **CHEERS FOR** moved from the station. All was very, **ENGLAND** very quiet. Then the Americans themselves raised three tremendous cheers for England, and the crowds in the stations responded, and so the train went out, and so the men went on to their business of making war.

Thank you, America. Your men, so fine, so friendly, so soldierly—they have given us the encouragement we all of us needed, and in the detachments you have sent over you have given us not only allies in the military sense, but friends as dear to us as our own brothers. Together we shall "see it through."

CHAPTER XIII

THE WORK OF THE RED CROSS

Our women are caring for the soldiers at the front today and they are working at home. Besides conserving food, they are knitting warm clothes and are making bandages and surgical supplies for the doctors and nurses at the hospitals behind the lines. Most of this work is done under the direction of the Red Cross. There are many branches of the Red Cross Service. When our brave men are wounded and fall on the battlefield they provide ambulances to go out and bring them to the hospitals. They have a saying in the trenches, "If a man falls wounded and the Red Cross gets hold of him he cannot die." However that may be we know that much suffering is prevented and many lives are saved by means of the Red Cross.

Through its organization women are in service. It is only in the last hundred years that women were **FLORENCE** allowed in military hospitals. During **NIGHTINGALE** the Crimean War, when France, England and Turkey fought against Russia, men lay ill and wounded in the hospitals in mud and filth, with no soap or towels and only coarse food. Florence Nightingale came to their aid. She was the daughter of a wealthy English family, who for many years had been devoting her time to the study of nursing in English hospitals. She came with a group of other women to the suffering and dying men. She saw that the sufferers were bathed and well fed. Letters were written home for them. They were carefully nursed and many of them recovered. The

soldiers of Crimea revered the name of Florence Nightingale. Money raised in her name was given by her to found a nurse's training school for girls in London, which still exists.

Inspired by her service, Henri Dunant of Switzerland published a book which advocated preparing for war in times of peace, so that the suffering of the Crimean War might never be repeated. He said that it would take many people working together to accomplish anything. So he called a group of men together at Geneva, Switzerland. Representatives came from fourteen different nations. This council resulted in 1864 in an international treaty which organized the Red Cross.

Each nation pledged itself to work with the other countries in war times in caring for all sick and wounded alike, no matter of what nationality. They also pledged themselves in time of war never to fire on a nurse or a doctor or an ambulance that bore the sign of the Red Cross. This pledge also Germany looked upon as a "scrap of paper." The Swiss national banner is a white cross on a red field. Because Switzerland originated the idea the organization adopted these colors reversed.

At the time of the Civil War in this country we knew nothing of the Red Cross, but Dorothea Dix, **CLARA** "Mother Bickerdyke," and Clara Barton **BARTON** were three noble women who worked incessantly to relieve suffering. Clara Barton was given a pass to go behind the lines, where she worked for Northern and Southern wounded alike.

When the war was over she went to Europe for a rest and learned of the Red Cross Society. France and Germany were then at war and she saw doctors and nurses of both sides working together caring for the wounded. She was greatly delighted with this band of trained men and women who were working to relieve suffering. Their watchwords,

“Humanity” and “Neutrality,” appealed to her. She began her efforts to secure for the United States the benefits of membership with the Red Cross.

This was accomplished in 1882 and Clara Barton became the first president of the American Red **AMERICAN** Cross. We were not at war, but Miss Bar-
RED CROSS ton found plenty to do. Her organization has taken care of suffering wherever accident or fire or flood has brought large numbers to want. A horrible forest fire in Michigan burned hundreds of homes. The Red Cross collected clothes, food and money for the sufferers. The Mississippi flood of 1882 destroyed millions of acres of cotton and sugar. The Red Cross provided seed for planting anew and furnished other relief for the homeless people. At the time of the Johnstown flood the Red Cross identified the dead, fed the hungry, and provided clothes and homes for the sick and homeless. At the time of the San Francisco earthquake they fed three hundred thousand people in the bread lines. Since 1905 there have been nearly a hundred calls for the Red Cross in the United States, because of disaster. Every Christmas time we are urged to buy Red Cross stamps, which provide money to prevent tuberculosis.

Even before our country declared war, our Red Cross had spent millions of dollars in equipping **PEACE** ambulances, nurses, surgeons and sending
SERVICE hospital supplies to the front. As soon as we entered the war they took upon themselves the work of looking after the needy families of those who had gone to the front. Three times we have had an opportunity to subscribe to the Red Cross campaign, and millions of dollars have been collected. Five million people have offered to do Red Cross work and to January, 1918, over forty millions of dollars had been expended. A hundred million dollar war fund was over-subscribed.

The aims of the Red Cross war council are three: (1) To be ready to care for our soldiers and sailors on duty wherever and whenever **RED CROSS AIMS** care may be needed. (2) To shorten the war by strengthening the morale of soldiers by looking after their interests at home. (3) To lay foundations for an enduring peace by practical relief and sympathy to all the peoples of the Allies.

At home the Red Cross is taking such measures as are necessary for the protection of health and welfare of our soldiers in camp. It guides the work of the women in the making of knitted clothing and surgical supplies. It cares for dependent families of men in military and naval service.

The Junior Red Cross was recently organized to give the 22,000,000 school children of the United States an active share in war work. The work is carried on entirely as a part of school duty. Working under supervision, boys and girls knit socks and other garments and make many of the simpler dressings and relief supplies.

A Medical Advisory Committee, including our foremost physicians and sanitary experts, has been appointed and, under the Red Cross, is hard at work at home and abroad.

The War Council has sent to Europe five separate commissions so that we may be familiar with all **LEARNING THE NEEDS** the needs of our Allies. Commissions have been sent to France, Russia, Roumania, Serbia, and Italy. Representatives have gone to England and a special department was created for Belgium. Major Murphy, the head of the Commission, is in France and is a member of General Pershing's staff, so that he may be in close touch with the army.

The Red Cross works among the civilians, caring for and educating destitute children. They care for mutilated soldiers as well as sick and disabled ones.

In the devastated countries of France and Belgium they supply tools, household goods, food, and clothing.

France has suffered beyond description. While our army was getting to France it was necessary to **AIDING THE FRENCH** strengthen the courage of the French soldiers and people. Needy sick and wounded soldiers were cared for in hospitals. Dispensaries were provided and canteens established. The chief work was in taking care of the French orphans. Many children, ranging from babies to those eight years old, were sent from the towns on the war front to cities far away, to save them from gas and shells.

The greatest need of France is aid for the French refugees. They have fled before the approach of the German army, having no money or food. In many cities whole families live in a single room. Disease develops, and relief is demanded. Fifty thousand yards of flannel and great quantities of condensed milk, flour, dried vegetables, corn beef, rice, beans, sugar, shoes, blankets and sheeting have been sent from the United States for Red Cross relief work. Nearly eight hundred and fifty thousand refugees, embracing all classes except able-bodied men, have received help. When the war is over they will need more assistance to go back to their homes and begin life over.

The sick and disabled men discharged from the French army are many. The wounded receive a pension, but the invalided soldiers do not. Of these three hundred thousand men, perhaps one-half are tubercular, and their earning power is slight. When they are discharged from the army, separation allowances to their wives and children cease. When their uniforms are gone they have no money even with which to buy clothes.

The Red Cross offers temporary relief in many

cases. The mutilated soldiers are furnished with artificial legs and the blind are re-educated to earn their living in a new way. In every way possible the Red Cross helps. To prevent the spread of tuberculosis from these returned soldiers is a great problem. Five hundred thousand cases have developed since the beginning of the war. Sanatoria and hospitals have been constructed. Four beautiful chateaux of France equipped for use have been turned over to the Red Cross.

When the American troops started to France the Red Cross saw that every man was given a comfort kit containing heavy socks, handkerchiefs, wash cloth and soap, pencil and writing paper, material for smokes, games, buttons, and other small articles. The Red Cross saw to it that no American soldier was forgotten at Christmas time, in his first winter in France.

When our soldiers land in France they are taken first to large reception camps on the coast, conducted by the Red Cross. Along the route followed by the troops, the organization has infirmaries and rest stations in charge of an American trained nurse with a man to help her. Each infirmary has a dozen or more beds with drugs and other necessities. Those seriously sick are cared for in French hospitals. When our men reach their French base, the Red Cross acts as a friendly agency to provide rest and recreation.

When the survivors of the sunken transport "Antilles" reached port they were met by a Red **SERVING OUR BOYS** Cross representative with money. They had lost everything they had, and some were dressed only in their night clothes. The Red Cross attended to notifying their families of their safety, and provided them with what they lacked. Great care was given to visiting the wounded in the hospitals.

The Canteen service feeds men everywhere. It furnishes food to men in railroad stations and sees that they have a bath, and when time permits, a rest. Near the firing line are established the field canteens. These are in or near the second lines, where men going to and from the trenches can be refreshed. Each station keeps about one hundred and twenty-five gallons of hot drinks at the boiling point. Sometimes four thousand men are served in a day. Many of these stations are in charge of women. Women in canteen service must be between thirty and fifty years of age and of robust health, for it is a very hard life.

The Red Cross supplies the field or base hospitals with ether, surgical dressings and instruments. Ten portable ice-making plants were set up in France for supplying base hospitals.

More than half the eight hundred and sixty-four persons handling the work in France are working **BEHIND THE LINES** without salary or even living expenses from the Red Cross. Prominent American business men, experts, and women are working without salary. The other half are paid by their former employers or from private subscriptions. At the front they establish and keep up canteens, rest houses and recreation huts to supply American soldiers and our Allies with all the comforts the army authorities approve. They distribute supplementary hospital equipment for the Allied armies and maintain emergency hospitals whenever the need arises. Thus along with the terrible carnage and destruction of war goes this beautiful work of healing and service.

CHAPTER XIV

FROM AN AMBULANCE DRIVER

Dear Father:

"All we do is to go up for attacks. Night before last, we came out from a perfect hell—by far the **THE APRIL '18** worst we have ever gotten. We were **DRIVE** on duty three days and three nights. I put in forty-eight hours with but five hours sleep. During that time, we lost one of the twenty members of our section, a noble fellow who was killed, three were wounded and fifteen of our twenty cars were hit by shells. The steady bombardment was awful. We were at what was about the most violently contested point. Picked French and English troops fought like demons against the best Boche troops—including their Prussian guards.

It is not possible to describe such bravery, pluck, and wonderful morale. Never a whimper nor a complaint and the poor fellows were blown to pieces as I have never seen before. Two regiments we worked with had been through two Verdun offensives, and they said that this was undoubtedly the most bloody affair in the history of the world.

At one time, the Boche advanced into the lower edge of a village, about as large as the park at home. **COUNTER** The French dropped back to a hill behind, **ATTACKS** with the Boche 400 yards away and crossed the machine gun fire, which made it possible to leave the cellar used as a first aid station. We four Americans and seven French stretcher bearers, who were with us, destroyed our papers, divided our bread and then lined up, expecting to

be taken prisoners. The Boche, however, were checked and driven back. All day and all night counter attacks took place. I thank God we got out as well as we did.

The fields on both sides of the roads to the posts were filled with English and French batteries doing mighty fine work. Everywhere were the reserve line trenches and machine gun posts with the troops in them day and night. Those lines acted as a second trench. We passed them and went so far up that the Boche not only saw our ambulances but fired upon them with machine guns. By doing this, we gained considerable time in getting the wounded just as they came from the attacking regiments. No battle could be a more bloody affair. One side or the other always making either an attack or a counter attack. The wounded could not be brought back from the front line except after dark, consequently, many lay out all day with most frightful wounds. Men went mad under the bombardment.

As long as I live I will take off my hat to every French soldier. Most especially do I admire the **VALIANT** pluck and courage of the Moroccans. One **FRENCH** afternoon they not only stopped the Prussian guards but went through them. At one time, some English troops on our sector went thirty-six hours without an ambulance section. The shell fire was so terrific along the roads that their drivers simply would not go out, and there the poor chaps lay fairly crying to be taken back.

I remember one night we waited for a barrage to decrease slightly so we could go out to the post. When we arrived, the two cellars were filled with wounded and many lay out in the street. The priest who was aiding the wounded cried when he saw us, saying, "I knew you boys would come." No human being could have resisted doing all in his power to get them out. I would have been glad to work twice

eighty-four hours without rest if it had been necessary to reach those brave fellows who were so desperately wounded.

One night, the night before we arrived, a certain village had hardly been touched. Twenty-four **APPALLING** hours later, that village consisted of **SIGHT** piles of brick where walls had been. All in one night the place burned. One house along the road was filled with grenades that kept exploding for hours. Some of the sights I have seen lately would have broken my heart, if I had not become somewhat hardened to them by my experiences during the past year. Death and the individual man are nothing at all. So often I wonder how long these mad people can continue. The more one sees of war, the more it is hated."

Part II. Geography of the War

CHAPTER XV

THE STORY OF ALSACE-LORRAINE*

The battle-ground of the West Front has embraced the territory of Alsace-Lorraine. One cause of the bitterness and suspicion in Europe for many years has been Germany's seizure of Alsace and Lorraine. We have only to read the story of these provinces to realize what the German yoke might mean to us.

When Germany defeated the French in 1871, they forced the French to cede to them Alsace and Lorraine, which lie along the borderland between the two nations, on the south bank of the Rhine River. In early times they were within the Roman Empire, which extended to the Rhine. Beyond the river then were the barbarous tribes of the Teutons. When Rome fell, the Teutons spread south of the Rhine and became the ruling class in these provinces. When modern nations began to arise, Alsace-Lorraine belonged first to France, and later to different states of Germany.

The provinces later fell into the lap of France again, but through no conquest on her part. Alsace was given to France as a reward for her aid to Germany during the Thirty Years War. Lorraine was, for a time, in possession of Stanislaus, the father-in-law of Louis XV, ruler of France. When Stanislaus died, Louis inherited Lorraine, which then became a part of France. When these

*Some teachers will prefer to read Chapter XXV at this point.

provinces came into the possession of France, the people living in them used the German language mainly.

In 1789, when the French people set about getting rid of their king and obtaining self-rule, the Alsace-**DRAWN TO FRANCE** Lorrainers came to admire the French very much. Many of them joined the French army and fought for the republic under Napoleon. It was during these years that the French national hymn, the Marseillaise, was first sung, at a dinner given by the French Mayor of Strassburg in Alsace. The Alsace-Lorrainers continued to take part in all French affairs and to fight for French liberty. Without any pressure from France, the people came to use more and more the French language and customs. Since 1815, the Alsace-Lorrainers have been largely a French people. This process of cementing the provinces to France was continued until 1871, when France was forced to give them over to Germany.

The deputies of Alsace-Lorraine at this time protested against this cruel separation from what they **TORN FROM MOTHERLAND** considered their mother country, and they expressed the feelings of the greater part of the people in the provinces, but to no avail. After three years, 1874, the Germans allowed deputies from Alsace-Lorraine to take seats in the Reichstag in Berlin. When they first appeared in the Reichstag, these deputies again protested against the annexation of their land by Germany. But the other members of the Reichstag only laughed and jeered at this protest. Some of the leading Socialists of Germany at that time also protested against the annexation, and were imprisoned for their boldness. Von Moltke, Germany's leading general in the war of 1871, declared shortly after the war that it would require no less

than fifty years to wean the heart of her lost provinces from France.

There were several reasons why Germany wished to get control of Alsace and Lorraine. One of these **BASIS OF GERMAN INDUSTRY** was because the provinces contained an immense amount of coal, iron and other minerals. These have meant a great deal to German prosperity. By annexing them, Bismarck made his country much richer. The Germans wrung from France an indemnity of a billion dollars in gold, but what was far more valuable to Germany was the title to Alsace-Lorraine. Her rich mines of coal and iron made it possible for Germany to produce the high grade steel for her great industries. New plants were established to make steel for German manufactures and for the great Krupp guns.

Within thirty years Germany surpassed England, first in the production of pig iron, then in the matter of steel, and then in the chemical industries, all based on the iron and coal of Lorraine. The Germans obtained such great riches from these two provinces that their conquest went to their heads. They felt that war was profitable and would always bring them great returns. Therefore, they laid their plans for larger conquests.

But, besides the prosperity and wealth the provinces brought to the Fatherland, there was another reason for taking them. **MILITARY DEFENSE** Count von Moltke persuaded Bismarck that the possession of Alsace-Lorraine was necessary for Germany's defense against France in future wars. The Vosges Mountains, he said, would be a far more satisfactory boundary line from a military standpoint than the Rhine River. Ever since then the Germans have claimed that the Vosges Mountains form the natural boundary line between France and Germany, and that the line must remain there. This

military reason was doubtless the principal one for the taking over of these provinces.

There was one further reason. That was, that in ancient days, the people of Alsace-Lorraine had **GERMAN LANGUAGE** spoken German, and the Germans claimed that the provinces had been taken from them in the first place, and that these brothers of theirs were merely being brought back to the Fatherland. Many of the liberty-loving Swiss speak German, too, but Germany has not yet forced them back into the Prussian-ruled Fatherland. But of all the reasons for Germany's seizing these two provinces, the leading one was that they needed them for purposes of defense against the French, although since that time the mineral wealth of the provinces outweighs all other reasons for holding on to the last ditch.

When Germany signed the Treaty of Frankfort in 1871, taking over Alsace-Lorraine, she agreed to **EMIGRATION LIMITED** allow all the inhabitants of the provinces who wished to leave the country, to do so, providing they went before October 1st, 1872. By that date, sixty thousand of the Alsace-Lorrainers had left the home country, all going to France, or to the French colony of Algiers. Shortly after the date limit arrived, a hundred thousand others tried to leave the country, but they were not allowed to go, because they had not gone before the prescribed date. However, ever since 1871, the emigration of a few families at a time has continued all along, making in all from five to twelve thousand each year. It is claimed by the French that fully half a million people emigrated from the provinces between 1871 and 1910.

Many of the Alsace-Lorrainers who emigrated, did so because they did not wish their sons to be **GOING TO FRANCE** forced into the Germany army and be liable later to kill their relatives and friends in

France. Those that were not allowed to emigrate after 1872, claimed the right of foreigners, that is, their freedom from military service; but the German government refused to grant this right and the consequence was that many of the young men of the provinces, who wished to pursue a military career, went to France. In the German army, they had very little chance for promotion as officers. It is said that in 1914 there were only three Alsatian officers in the German army, while there were thirty generals from this province in the French army. In the dozen years immediately preceding this war, twenty thousand boys fled from Alsace-Lorraine to enlist in the French army.

As Germany was anxious to make these provinces purely Teutonic, they sent into Alsace-Lorraine **GERMAN COLONISTS** many colonists as emigrants. These colonists were people from all the walks of life. By 1914, out of the 1,800,000 inhabitants, four hundred thousand were said to be emigrants from various parts of Germany. These immigrants did the very things that would make them unpopular with the native inhabitants. They boasted of German greatness and German virtues, and they boldly paraded all their Teutonic customs. This naturally forced the Alsace-Lorrainers to cling the more tenaciously to the French ways of life.

When Germany took over Alsace-Lorraine it was thought best not to annex them to any one of the German states, because this might create jealousy in Germany. Bismarck thought it a wiser plan to make Alsace-Lorraine a Crown territory, called Reichsland, which was to be directly under the control of the empire and the Kaiser. That would make all the states in Germany equally anxious to retain the annexation, and prevent their ever returning to France.

So, for the forty years previous to 1911, Alsace-

Lorraine was merely a conquered territory, with **NO SELF-RULE** little to say in its own affairs and none in those of Germany. It was ruled by the Emperor, by the chancellor appointed by him and by the German House of Lords. In the provinces with his seat at Strassburg, sat the governor-general, who represented the Kaiser and ruled for him. It is true that the Germans had allowed the Alsace-Lorrainers to have representatives in the Reichstag, the lower house of the German government, but this house has very little power. So, while different members have been sent from Alsace-Lorraine to the Reichstag, they have had no influence, because that body has had so little influence in the government of Germany. Until 1911, therefore, Alsace-Lorraine was not represented in the real governing power of Germany.

From the beginning there had been a growing number of people in Alsace-Lorraine who demanded the right to rule their own affairs. At last, in 1911, Alsace-Lorraine was given a constitution and allowed to send three delegates to the Bundesrath, the German house of lords; but these were not to be elected by the people. On the contrary, they were appointed by the governor-general, who was an instrument of the Kaiser. This arrangement did not satisfy the Alsace-Lorrainers, because it did not give them a real representation.

By this new constitution, the local government of Alsace-Lorraine was placed in the hands of a legislature, but the upper house of this **CONSTITUTION A BLIND** legislature was controlled by the emperor, who appointed one-half of its members and could therefore control it by preventing the passage of any laws that did not please His Majesty. Moreover, the Alsace-Lorrainers had still no power to elect their representatives in the Bundesrath. Up

to the beginning of this war therefore the lost provinces had failed to obtain their freedom.

The Germans have done little to conciliate the people of Alsace-Lorraine. They have looked upon **FRENCH** the provinces as conquered lands, and **FORBIDDEN** have treated the people in the domineering way that would create more bitterness. A great many annoying laws were forced upon the Alsace-Lorrainers to bring about the use of German customs and the German language. Only the German language can be used in the schools and churches, but French is still widely spoken in the homes and on the streets. Newspapers are printed with both German and French on the same page. In the shops one is waited on with equal courtesy, whether he speaks French or German. In the theaters French is allowed to be used only once in two weeks, but French plays are regularly presented as often as allowed.

The street signs are all in German, but the people who refer to them do so generally in French. The German government ordered that no new French business signs could be put up over the stores. The old French signs, no matter how dilapidated, are still kept over many shops. If the owners should try to paint the signs, that would be the same as putting up a new sign, and it would have to be painted in German. The business people, in many cases, speak German in their place of business, but when they reach home there is no German word heard. In their homes, and in private places, the Alsace-Lorrainers still speak their native French.

There are many petty and annoying rules in the provinces. For asking the orchestra to play the Marseillaise, or for whistling it, people have been expelled from the country. When the French veterans of 1870 get together to rejoice over old times, their meetings are dispersed and their guns

taken from them on the ground that the guns are being held without a license. Those Alsace-Lorrainers who left the provinces in 1871 are allowed to visit the old home only three weeks in the year. If when they come back they neglect to secure the required police certificate, they are driven out at once. Those who come back on business trips are allowed to see their clients at the railroad stations only. They are not permitted to enter the towns.

Parents are not allowed to send their children to foreign schools without a permit from the government, and this is difficult to obtain. **DESIRE FOR FRENCH TONGUE** If they send their children to such schools without the government's permission, the parents are liable to fine and imprisonment. In this way the German government is trying to prevent the younger generation from learning French; but these harsh rules only make the desire keener and the determination firmer to acquire that language.

French newspapers of a certain kind may be brought into Alsace-Lorraine, provided they have agreed to omit all reference to Alsace-Lorraine. This is Germany's plan to quiet all discussion of this troublesome question among the people. But those who live along the border of France drive across into French territory, buy the prohibited French papers, and hide them under their clothing as they go back across the line. The Germans have levied a high tariff on many French goods across the border.

Young men who leave Alsace-Lorraine to avoid army service are not allowed to return until they are forty-five. If they do, and are discovered, they are heavily fined. The consequence is, that unless the parents of these young men have ample means to travel in France, they may never live to see their sons again. Even if they are able to travel, they

must get the permission of the German government before they are allowed to cross the border.

During the army maneuvers in the fall of the year, the Alsace-Lorrainers are compelled to lodge and feed as many soldiers as Germany asks them to support. The German government also employs many spies to watch the Alsace-Lorrainers and report those who are favorable towards France. When any are discovered who favor France, they are made to suffer for it.

At a certain large locomotive works near Strassburg, which supplied locomotives to the railroads **PERSECUTING** thereabouts, one of the directors of **FRENCHMEN** the company was a lover of France, and made no attempt to conceal the fact. Suddenly one day the company was notified that unless they discharged this man the company would secure no more orders from the government, and of course they had to give him up. These annoying rules and petty persecutions explain why the Prussians are hated in the lost provinces and indicate why Germany is not loved by her colonies.

At a certain town named Zabern in Alsace, there was in 1913 a German barracks where portions of **ZABERN** the German army were held and trained. **AFFAIR** Here there grew up at that time much ill feeling against the Prussians. One of the young Prussian officers insulted the Alsatians and showed his contempt for them. When they heard about his remarks, the people, especially the young boys, returned the insult when they met him on the street. The feeling became more intense until finally the Prussian soldiers dispersed a crowd and arrested thirty people illegally. Among them were judges and other local officers. They were kept over night in a coal bin.

This insult with the illegal acts of the army stirred up the Alsatians against the Prussians, and

there was deep bitterness. The German government did little to quiet the feeling in spite of the fact that the Reichstag made protest against the acts of the soldiers. Even during this excitement the insulting lieutenant struck a lame shoemaker in the face with his saber, while he was being held fast by other soldiers, and inflicted a severe wound.

The whole affair showed that the civil population had no rights against the Prussian military **ARMY** officers; that when the people are abused **ABOVE LAW** and their laws broken by the Prussians, the Kaiser and the German government favor the military officers. Thus, this Zabern affair caused a growth of bitterness that was not allayed when the war began. The whole affair proved that Germany was ruled by the war lords instead of by the voice of the people.

Notwithstanding the tyranny of the government, Alsace-Lorraine, because of its steel and coal, has become a very important center of the empire. The population has increased by 300,000. Canals have been dug and railways built. The cities have sanitary provisions of the most modern type, and German schools have been established. Many of these advantages, however, would have come to the provinces had they remained in the possession of France. This progress came in great part because Germany's prosperity was based upon the iron and coal mined here.

CHAPTER XVI

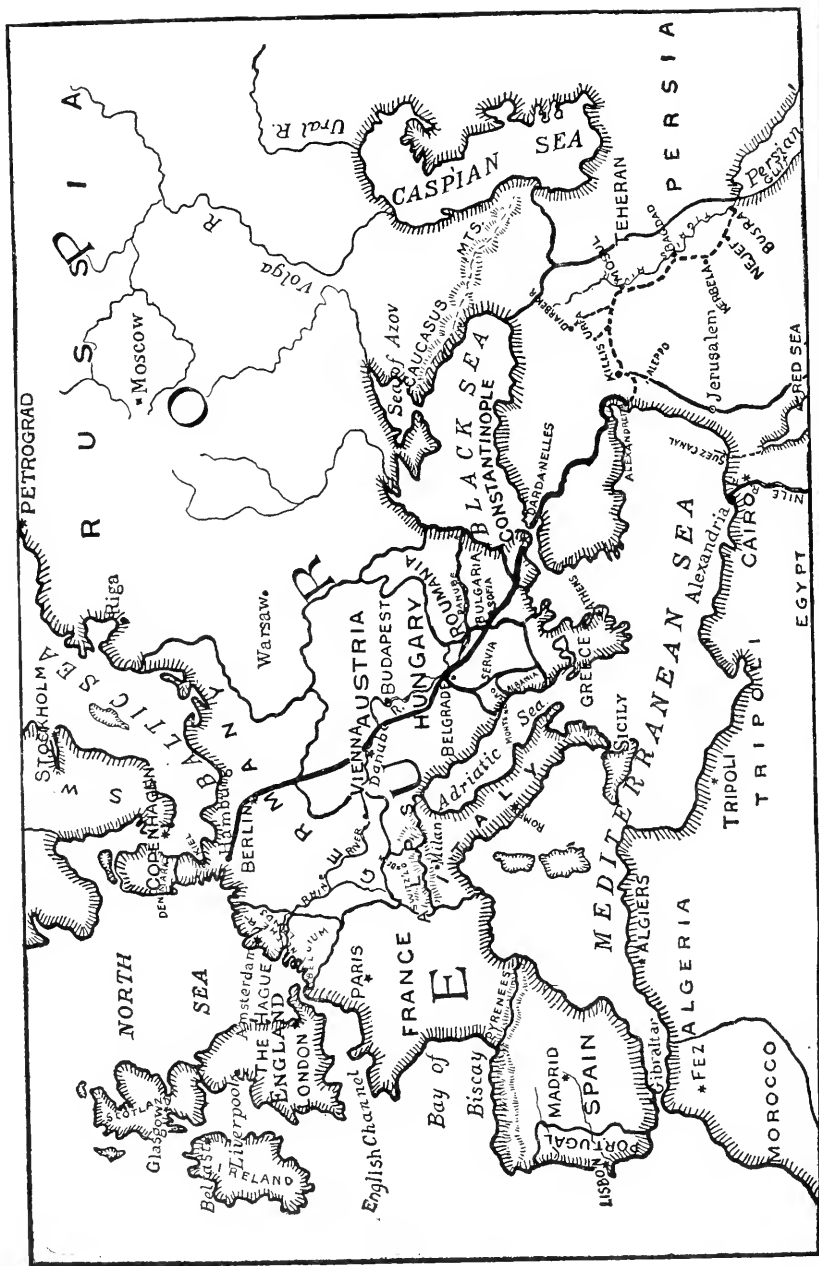
THE SCHEME OF THE BAGDAD RAILWAY*

By 1890 Germany had become a manufacturing and commercial nation. German trade had begun to penetrate into all quarters of the world. Her population had also increased tremendously. But as she had no foreign possessions suitable for colonization, her surplus population was obliged to migrate to foreign lands, where they in time ceased to be German. The result was that the Fatherland was not building up an overseas empire. Her trade too was almost entirely with other nations and their colonies.

Not content with being the leading nation on the continent of Europe, Germany planned to become a **BUILDING** world empire. Great Britain had colonized **A FLEET** the best portions of the world, and there was little chance for Germany except by force of arms. Germany, therefore, began building a great fleet, and the Kaiser declared that Germany's future lay upon the water. No attempt was made to conceal the fact that this fleet was to be used against England.

Great Britain, whose empire depended upon a superior navy, twice suggested to Germany that they agree to limit the new warships to a certain number each year, because it was becoming a great tax burden upon both countries. But Germany refused and even increased her shipbuilding program. Both nations pushed their plans madly without regard to cost; but England had so much the start

*See World War, Chapter 2.



that Germany could not equal her on the sea though she kept adding to her navy.

At the same time Germany was planning and scheming to seize upon a great continental empire extending through Europe and well into Asia. By universal military service Germany had trained her entire male population for army life and had built up the greatest army and fighting organization ever known. With this she meant to seize as much of Europe and Asia as she wanted. England's empire and fleet would fall to her later.

For many years the ruling classes of Germany have been planning and plotting to seize for themselves the best portions of the world, **MITTEL-EUROPA** cause they have believed themselves superior to all other peoples and therefore destined to rule. In their dreams they saw the German Empire, beginning at the Baltic and the North Sea and extending through Austria-Hungary and the Balkans, Turkey, Asia Minor, and Mesopotamia, down to the Persian Gulf. The Germans called the empire of their dreams "Mittel-Europa." It was a vision of empire similar to that of Rome in her balmy days, an empire of 160,000,000 people under German control. Over this magnificent realm the Kaiser would rule, a successor of the Caesars.

But this was only the beginning of their dream of empire, for, after this first step, they thought England could easily be crushed and her empire and fleet seized. Africa, Asia, Australia, and, finally, the Americas would easily fall before Germany's growing power. Thus the world was to be ruled by Germany and all nations would surrender and take up the German language and German "Kultur." The most difficult step in this grand march was the first step, which Germany plotted to take before the world awoke to her towering ambition.

The **Mittel-Europa Empire** was to be built upon

and held together by the Rhine-Danube rivers and **BAGDAD** the Bagdad Railway. When completed **RAILWAY** the railway was to be a continuous European-Asiatic system, beginning at Hamburg and extending through Berlin, Vienna, Constantinople, Asia Minor, and along the Tigris River valley to the Persian Gulf. It was to be one of the greatest railway systems in the world.

Germany is now a small country, not so large as the State of Texas, but with a population of seventy millions. Her crowded numbers live largely in cities and support themselves by manufacturing products to sell to the world. It is only by well-organized industries and a splendid foreign trade for German goods that her people can feed themselves and prosper.

The German government has done everything in its power to aid the people to win foreign trade for **BUILDING UP** their products. It has made good **COMMERCE** bors out of poor ones and created a system of inland waterways and railroads, all carefully controlled by the government. The railroads and canals are operated to favor German travel and German goods. Freight rates are adjusted so as to enable a German merchant or shipper to sell at a lower price than foreigners can sell.

All travel and shipping of goods from Germany is done over German routes and in German ships. The government makes all rules and regulations, so that all the money paid for the production and carrying of goods to foreign countries shall go to German firms. The German post office, for example, will carry mail to the United States for two cents a letter, provided it is carried on a German ship; otherwise five cents is the rate for a letter. This is one of the many ways that Germany uses to build up her shipping power.

The great trade artery of Europe is the Rhine

River, and Germany guards it as the foundation of **THE RHINE VALLEY** her strong position in Europe and in the trade of nations. Armies can be moved back and forth upon the Rhine quickly and easily, and it is so navigable that the inland cities along its banks have been converted into seaports. Great barges make transportation easy and cheap. In some years there are more than fifty million tons of merchandise carried upon the Rhine, and this is equal to one-seventh of all that is carried on the railways in the empire. In the harbors lie great fleets of German steamers ready to sail to almost every known part of the world and to do everything they can to help build up the German traffic. The German ships bring back fuel for the furnaces, grain for the mills, wool, cotton and silk for the looms, wood for the lathes, and even food for the workers.

During the last thirty years her foreign commerce has increased two hundred and fifty per cent; so that Germany is now second only to Great Britain in commerce. In this way Germany has kept her people at home and given them occupation.

There have arisen in Germany great industrial classes that have become very powerful. The big **INDUSTRIAL CLASSES** industrial magnates like the Krupps, and the great bank institutions, exercise a great deal of power in Germany. The great captains of German industry had a vision of empire such as would give a still broader field for German trade and industry and commerce. They worked hand in hand with the powerful German banks, which were to have branches throughout these wide regions. The captains of German industry were probably as insistent as any other class upon the conquest of Serbia in order to push German claims into Turkey and Asia Minor, to connect up the great Middle Europe empire.

The German people were interested in this great

project, because of the outlet it offered for trade **WORKERS** and positions for their educated men, **INTERESTED** as well as for the migration of their crowded population into lands where the Germans would not lose connection with the mother country. The working classes saw in this scheme well-paid employment, not only at home, but of inviting opportunities in these new territories. It was an opening vision like that which England enjoys in South Africa, India and her other colonies; and which France enjoys in Morocco and Algiers, but far more promising.

The Germans began building this railroad system on the Asiatic side of the Dardanelles. The main line to the Persian Gulf was to be 1,700 miles in length. There were to be branch lines to important Mediterranean ports, and it connected with other lines running south through Palestine, which ended on the outskirts of the desert, dangerously close to The Suez Canal and Egypt. Branch lines ran eastward to Persia, which was under British and Russian control.

But the most menacing thing of all was that the main artery ran from Bagdad to the Persian Gulf, **MAIN LINE** where a German naval base was to be built and a harbor for the German fleet. This would be connected directly with Germany by rail, and would enable Germany to threaten India, Australia, East Africa and British interests in China and the Pacific Ocean. The railway was to have been opened for traffic in 1917.

Thus the Bagdad Railway was a drive at the very heart of the British Empire. It struck the Suez Canal and British control in the Mediterranean, and menaced two centuries of British Empire building. It meant the ultimate control of Turkey with her twenty million people and all western Asia, as well as the Balkan states.

The Bagdad Railway would bring to Germany immense opportunities for overseas trade, commerce **PAN-** and industries along with the control of **GERMANY** this vast territory. Mesopotamia and the Balkans are the richest undeveloped portions of the earth. By means of the railway Germany would be able to control the industrial life of all these countries. If Mittel-Europa could be realized it would make Germany so powerful that no nation or group of nations could withstand her drive for world control. Pan-Germany is the name given to this colossal world empire which is the star of German ambition.

The first step in this drive by Germany was taken in 1888, when they obtained from Turkey permission to build railways to Asia Minor. Ten years later, when the Kaiser visited Constantinople, he obtained a concession from Turkey for the Bagdad Railway project, which was to reach to the Persian Gulf. It was to be the bridge from Hamburg to the Orient.

For building the railway Germany was to have certain concessions. She was to have great land **GRIP ON** grants on both sides of the railway through- **TURKEY** out its length, similar to the grants given by the American government to our Pacific railways just after the Civil War. Germany was to furnish the money, and build and operate the railway, but Turkey was to guarantee the interest on all money invested in it. If the railway should not prove profitable, or if Turkey should fail to meet her payment of interest, then Germany would step in and take control of the government of Turkey until the money was paid. In this way Germany expected eventually to assume control of the Turkish empire.

The land grants on either side of the railway amounted to 12,600 square miles. Thus upwards of 100,000 acres were transferred to Germany for the raising of cotton and wheat which would help to free

Germany from dependence upon the outside world. Cotton, which would relieve her from dependence on United States and England, can be raised on the land of Asia Minor; and Germany was doubtless distributing seed and training the people how to grow cotton here.

The Tigris-Euphrates valley is the finest wheat land in the world when it is irrigated. Only irrigation is needed to bring back a **SEIZING POINTS OF ADVANTAGE** civilization in the Tigris Valley similar to that which prevailed in ancient times, when twelve millions of people subsisted on the products of this great valley. There were concessions for mines, as Asia Minor is rich in minerals; for oil, which Germany needs badly now; for the building of docks, harbors, warehouses, and for exclusive privileges of other kinds. Germany already has extended her banks into many of these regions and is getting the finances in her control and undermining Turkish banks, just as she has done in Roumania.

It is very clear that in order to carry out this colossal plan of the Bagdad Railway, Germany needed the friendship and the actual control of Turkey. That is the reason why Turkey was brought to Germany's side in the beginning of this war. Turkey and Asia Minor mean more to the financial and commercial classes of Germany than any other portion of the world, because they offer a market for the surplus wealth of Germany and for her surplus products. This country is one of the greatest possible markets in the world, and it is the only one left unappropriated by the other powers. Therefore, Germany bent all her energies toward getting control of it.

The Rhine-Danube river system is everything to the Mittel-Europa of Germany, for it is the base of

RHINE-DANUBE WATERWAY a gigantic program of canal construction. The Germans have taken up a scheme of connecting the Danube with all the different rivers of Germany, with the Rhine and the Oder and the Vistula. By a vast network of canals she plans to use the Danube as the great backbone of water transportation through Mittel-Europa. This in connection with the Berlin-Bagdad Railway would make Germany supreme in the matter of transportation throughout Central Europe.

Such a system of canals, together with the low cost of transportation afforded by them, would make it profitable for the Germans to pay high wages to their own workmen, and yet at the same time bring about such a reduction of net prices in every line of industry as to force German products upon the whole world by their sheer cheapness. This would bring about the economic ruin of the Allies, and so exhaust them that they could not pay their huge war debts. It would bring about their subjection to Berlin in all matters economic as well as political. Besides, there is not a country in the world which could escape the clutches of Germany on account of this economic condition.

The entire Pan-German plan hinges upon Serbia. Without Serbia the Pan-Germany of the Kaiser is impossible, for without Serbia it is impossible to have a German controlled railway from Hamburg to Constantinople and beyond, because the railroad runs through Belgrade and for many miles through the land of Serbia. Moreover, without Serbia Germany cannot control the Danube.

Germany, then, depends upon retaining Serbia at all hazards at the close of the war. She would be willing to give up many other conquered districts, if only she is permitted to hold Serbia, and thus make complete her control of the Danube River and

Hamburg-Bagdad Railway, and all that this means to her.

Knowing this, Germany has been eager to destroy Serbia as a nation as completely as possible. **MASSACRING A NATION** Serbia is said to be one great graveyard. Her population has been butchered by the Bulgarians with the approval of Germany, and Serbia is utterly ruined. The Bulgarians, Austrians and Germans have taken everything, and massacred a large part of the population, with the hope of bringing in colonies of their own people. The plan is, that even if Serbia is given up, there will then be enough Germans, Austrians, and Bulgarians in Serbia, so that after a short time this country will pass into Teutonic hands.

France has loaned billions of dollars to Turkey and the Balkans, and her interests here would be threatened. France has always been the favored money lender among these countries. Her loans to Turkey alone amount to four hundred million dollars, four times that loaned by Germany.

France and Russia were very close allies, and the French people have loaned millions of dollars to **FRANCE AND RUSSIA** Russia. The Bagdad Railway would drive a wedge between these nations. It would also end the century-long ambition of Russia for control of the Dardanelles. The French bankers and railroad builders were ambitious to control Syria, just as Russia was ambitious that her Cossacks should control northern Asia Minor, and secure a Russian port upon the Mediterranean.

Russia can only finance her industries and pay interest on her loans, by the export of her wheat and oil, and in winter she can reach the seas only through waterways under control of other powers, for the Siberian Railway is too long to be a very effective route. Should Germany control the Dardanelles as she does the Baltic, Russia would be practically cut

off and left a mere vassal to Germany. Germany could dictate trade and customs and tariffs, as she has done with weaker nations. She could dictate the internal developments of Russia by controlling her export trade. Future Russia is dependent upon an outlet to warm water seas, and the free and unimpeded right to buy and sell where she wishes. Therefore, Russia and France have consistently worked hand-in-hand with England in trying to prevent the completion of the Bagdad Railway.

The ruling classes of England were greatly opposed to the German plan, for it menaced the British **THREAT AT** Empire. The Bagdad Railway would **ENGLAND** make it possible to place German and Turkish soldiers alongside the Suez Canal and Egypt in a third of the time that English soldiers could be brought by sea. It would cut at Suez, the chief water route that holds the British Empire together. Moreover, the German terminus on the Persian Gulf would be a naval base from which the German fleet could strike quickly at British possessions in the Far East, and at the same time be in close touch with Berlin. Its realization would mean England's downfall.

The American people are likewise opposed to the Bagdad Railway scheme because the Germans plan **AMERICA'S** to make it the basis of conquering Eng- **POSITION** land and then using the captured British fleet to bring America under the sway of Germany. America has always welcomed peaceful German immigrants, but when the War Lords plan to force German "kultur" upon the two Americas at the point of a bayonet we naturally resist with all our power.

A railway is needed from Constantinople to the Persian Gulf, and it will doubtless be built; but we are determined that Germany will not be permitted to make it the basis of world dominion.

CHAPTER XVII

BRITAIN AND THE MEDITERRANEAN

Nature seems to have fashioned the British Isles as a dwelling place for a great commercial nation. They are situated at the cross roads of the leading ocean lines of world traffic which gives them a great advantage in trade. The fact that they are west of Europe and east of North America, the chief commercial continents, is also much in their favor in trade matters. England is, in short, the center of the land hemisphere of the earth.

As bays and gulfs enable ships to go far inland to get their cargoes, any country, having an indented coastline has great advantage for cheap water transportation. The greater the length of coastline of a country the better. An island empire, therefore, always has superior advantage.

England is so deeply indented that no part of it is more than seventy-five miles from the sea, while **BRITISH PORTS** Scotland has the most rambling coast line of any country in the world. Ireland is not so deeply indented, but yet has many excellent harbors. The United Kingdom and Ireland contain 119 seaports, of which 80, even at low tide, are open to vessels drawing as much as 14 feet of water. At average tide they will admit vessels requiring much greater depths. Practically all of these harbors have been developed for effective use.

Not only are the British Isles a fitting dwelling place for a great commercial nation, but the English people have had the tact and cleverness to build up and hold together a great overseas empire. Canada,

*See World War, Chapter 7.

South Africa, Australia, New Zealand, India and hundreds of islands the world over are happy and prosperous under the British flag on which the sun never sets.

England has built up this world-wide empire not by harsh military rule such as Germany displays, **EMPIRE** but by giving to the people of her **SELF-RULED** dominions the right to rule themselves in so far as they prove fit to do so. Canada, South Africa, Australia and New Zealand are all practically independent of the mother country. They even levy tariffs on goods shipped to them from England. And the colonies have proved their loyalty in this war by rushing armies and munitions to the battle fronts. It is this world empire that has aided Great Britain to become the leading commercial nation.

One source of England's great strength lies in her control of the seas. This does not mean that **SEA** the warships are giving her this control, **CONTROL** but the unarmed liner following its regular route, or the slow speed tramps seen perhaps first at the London docks and a few weeks later at some far tropic port. The tonnage of ships flying the British flag is nearly twenty million, the United States comes next with less than eight million, then Germany with less than four and a half million. A great percentage of the American tonnage, however, is coastwise trade, while that of England is mainly overseas.

The very nature of England's trade demands this great merchant fleet, for her highways are those of the seas. The greatest port of tonnage is London, the second is Hong Kong and the third is Liverpool. While the commerce of England before the war was not increasing as rapidly as that of Germany and the United States, still it was far in the lead and still growing. To British ports come vessels from

every nation and to every seaport in the world are sent British-owned vessels on trading missions.

Millions of tons of staples are bought by England in the country of their origin, loaded on British **LONDON MARKET** ships, and delivered to her customers round the world, without touching at British ports. In the warehouses along the Thames and elsewhere are gathered the supplies of the world. Here you may see both the common and the unusual articles of commerce. The ivory of India and Africa are first brought here. The furs of the world are sold by auction in the London fur market. Mahogany logs lie on the London docks awaiting trans-shipment to other countries that are much nearer to their native growth than Britain. This English Island is the commercial heart of the world, and the slowing or quickening of its pulse is reflected in the most distant nations of the earth.

The vast extent of British sea trade is shown by the number of ship arrivals. In normal times an average of 214 ships arrive at United Kingdom ports from foreign waters every day in the year. In addition to those, there are 780 arrivals from home ports every day in the year of ships in the coast-wise trade.

British ships had, before the war, a greater total carrying power than those of all the other countries of the world put together. The merchant ships of Great Britain numbered nearly 12,000, of which over 4,000 were engaged in sailing between British and foreign ports. Few countries of the world are so dependent on the importation of foodstuffs as the United Kingdom. In peace times London is only three weeks from starvation. Probably 90 per cent of all the food for Britain's 45 million people must be brought in normal times from overseas. This makes it clear why she needs the strongest navy in

the world to protect her shipping. Any threat at her navy makes all England tremble.

More than three-fourths of the people of the British Isles live in cities and are engaged like those of Germany in manufacturing goods for foreign trade. No nation can advance far in manufacturing without abundance of iron and coal. Great Britain is rich in coal deposits of excellent quality. The mines are near and convenient to ocean ports which give access to cheap water carriage to all parts of the world.

In the history of British commerce, coal plays an all-important part. The foreign trade of Great **ENGLAND'S** Britain in the past has been based in **COAL RICHES** no small measure on her coal exports. It formed the bulk of the British outgoing cargoes prior to the war. Britain exported in 1913 about 97,000,000 tons of goods of all kinds, of which about 76,000,000 tons was coal. By taking on cargoes of coal for overseas the British shippers were able to bring back at low cost foods and raw materials, such as cotton, wool and timber which were needed by the British industries. By filling the ships both ways, freight rates were lowered and this was an advantage in favor of the British industries, as it enabled them to produce and transport their goods economically and thus to gain foreign markets.

Prior to the war Great Britain furnished nearly all the bunker coal for the ships that carry the **BUNKER** world's commerce. Great Britain, being the **COAL** foremost maritime nation, had established coaling stations along all ocean lines of commerce. She had coaling stations at Gibraltar, Malta, Port Said, Singapore, Hong Kong and Shanghai. These are but few of the British coaling stations which encircle the globe. By means of these she held control of the greater part of the world's supply of bunker coal. Ships of all nations, including those

of Germany, were supplied on the same terms as British ships.

Sixty-five per cent of the Island of Great Britain contains coal and iron ore, while Germany has only one-third as much. Five-sevenths of Germany's iron comes from Lorraine, which explains why she will refuse to the bitter end to return this province to France. Her vast iron industry has been built up with Lorraine iron. Without it she could not have carried on the war for six months.

The bulk of exports of both England and Germany are manufactured goods, such as textiles and **BRITAIN'S** iron and steel. To these Germany adds **FOOD SUPPLY** chemicals and England, coal. Both countries import food and raw materials. England has been depending much upon North America for her food, but in recent years she has been endeavoring to develop food supplies and raw materials in her colonies, especially those in the Far East. Nine-tenths of the food supply of the British Isles must come from overseas, and a great deal of it in peace times is obtained from Egypt, India, Australia and other eastern colonies. Not only food, but England's whole life and prosperity, depends upon her trade with her colonies and especially her colonies in the Orient, which are reached through the Mediterranean and the Suez Canal. England's short water-route to the East through the Mediterranean is therefore vital to her safety. The Bagdad Railway to the Persian Gulf would give Germany the great advantage in trade with these far eastern nations, and to that extent it would strangle British commerce.

One of the chief causes of bitterness among European nations these many years, though little has **MEDITERRANEAN** been said about it openly, is the **PASSAGE** control of the Mediterranean Sea. It is the great water communication extending more than a thousand miles from Gibraltar towards the

east and reaching into the heart of Europe and to the border of Asia. The Mediterranean is the only outlet for the commerce of the countries surrounding it, of Italy, Greece, and the Balkans, of Egypt and northern Africa; and it is the only outlet in cold weather for the great quantities of Russian grain and other exports that come by way of the Black Sea. Whoever controls the Mediterranean and the Dardanelles has firm grip upon the prosperity of all these nations.

Moreover the Mediterranean is the only direct water route from Europe to Asia and the Indies. This waterway, therefore, is the backbone of the British Empire. England has kept control of the Mediterranean by holding the western entrance at Gibraltar and the Suez Canal to the east, just as Germany is supreme in the Baltic. England also holds Cyprus in the northeast corner of the Mediterranean and Malta near the center. But Great Britain has never abused other nations with her sea control.

The control of this main route of trade and commerce from Europe to the Orient has now been challenged by Germany. Germany's drive to the east and her determination to build and manage the Bagdad Railway is a drive at the heart of the British Empire, because without control of the Mediterranean and the Suez Canal, England's empire, depending upon direct water communication, cannot be held together.

England has billions invested in her colonies, in Egypt, East Africa, Australia, India and the Far East. At least six billion dollars have been placed here. This represents loans, investments in railways, mines, and plantations and profitable enterprises of all kinds. England has been the great money lender of the world. Her overseas loans alone amount to twenty billions of dollars.

The financial and investing classes of England

have been the ruling classes. They are mainly the **INVESTMENTS** old landed aristocracy, enriched by **THREATENED** ground rent, mines, tenements, and railways. This class controls the House of Lords and the Conservative Party in England, and has great influence with the foreign and diplomatic service as well. All the interests of these people were menaced by the German drive to the east.

British shipping supremacy was threatened by the railway competition. England's shipping tonnage amounted, before the war, to twenty-one million gross tons, or about 40 percent of all the tonnage of the world. A great part of this is engaged in trade with the Far East. Two-thirds of the ships passing through the Suez Canal are of British registry. The Bagdad Railway threatens all this shipping profit, for it would substitute carriage by land for carriage by water, and the two billion dollars that England has invested in shipping might prove unprofitable.

England has also been the world's clearing house. Lombard Street is the financial center of the world. The commerce of every country enters the ports of London for storage and trans-shipment to other parts of the world. The financial leadership of England is largely dependent upon her carriage of the world's commerce. A railroad passing through Europe to the Indian Ocean in German hands threatens the control in Lombard Street.

England would perhaps lose control of the distribution of the products of the world. British exports and imports, passing through the Mediterranean in 1916, amounted to \$1,650,000,000, and this is carried almost wholly in British ships and financed through British banks by British merchants. The Bagdad Railway would permit Germany to place the product of her mills and factories in the Far East, as well as in the Balkans, in much less

time, and possibly at less cost than they could be carried by sea.

The great body of English workers are also vitally interested in the British Empire, for it affords a market for English goods and it is the manufacture of these goods that gives occupation to the plain people of Great Britain. They, too, are opposed to Germany's Bagdad Railway. The control of the Mediterranean, and with it Turkey and Western Asia, is the keystone of one empire and the dream of another.

CHAPTER XVIII

GERMANY'S ADVANTAGES IN THE WAR*

The blockade of Germany has made some serious problems for her to overcome in the matter of food, **GERMAN** but in money matters it brought a different result. When Germany found herself blockaded, she was forced to find ways of keeping up her own resources and those of her allies. This meant great difficulty in the matter of securing food, clothing and raw materials for making munitions. But Germany turned all these problems to good account. If her exports are small, her imports are correspondingly small, and therefore she has to send very little money abroad. This is in her favor so far as money matters are concerned.

The case is very different with France. That government, believing that England would keep the **FRENCH** seas free, placed enormous orders for **INTEREST** food and munitions abroad, and did not rely so much on her home supply to fill the nation's needs. The result was that the direct imports soon exceeded her exports by a billion francs a month, and for the difference France must pay her gold to foreign countries. The time will come when France must pay twelve billion francs of interest a year to foreign countries with no returning advantage, because her purchases of different products, such as munitions, were destroyed in use. Thus France is becoming poorer in gold every month of the war, while Germany is keeping hers at home.

There are several reasons why the war has cost Germany far less than it has cost the Allies. In

*See World War, Chapter 5.

the first place, in order to produce an output of various kinds of guns and projectiles, Germany, looking forward to the conflict, had already built up machinery and worked out many war problems beforehand when her war experts had plenty of time. She had great factories and arsenals that were ready to produce in large quantities without any costly experiments or delays.

On the other hand, in France and England, there was very little in the way of war materials ready **EXPERIMENTS** when the war broke out, and the situ-
COSTLY ation was still worse in Russia. It was necessary for these countries to set up quickly thousands of new plants, to equip them with machinery brought from America at vast expense, and to work out hastily new kinds of cannon, projectiles, and all the rest. Haste, and the necessity of solving huge war problems in war times, caused many mistakes. All this was paid for dearly.

Then, too, the Germans had worked out the wage problem during their leisure days of peace, and when war came they were able to keep the wages stable, to prevent strikes and so to produce their war materials at a much lower cost than could the Allies. All that Germany had to do was to extend her very efficient industrial methods, which had been tested in peace times, and so she avoided those immense losses of every kind which were incurred by disturbed labor conditions among the Allies.

Almost from the first the Germans have commanded with the bayonet the labor of about two **LABOR OF** million prisoners of war. In all the con-
PRISONERS quered countries Germany forced the entire able-bodied population, both men and women, from the ages of sixteen to sixty, excepting women with young children, to set to work for Germany and help produce materials to keep up the terrific fighting. For all this vast amount of labor, Ger-

many paid practically nothing, so that their war munitions and food for the army were costing them far less than that of the Allies, who had fewer prisoners to help them.

The Allies paid high wages to their workers and when their supplies ran short, they had to pour out their gold to bring in more supplies from Asia, Africa, and America. A large part of the wages paid these foreign workmen left France and England for all time. It is to the advantage of every country to keep its gold at home, by selling more goods abroad than it buys and having the difference sent home in gold.

Then there was the matter of coal and iron ore. In addition to their own mines the Germans immediately seized the important coal and iron **GERMAN STEEL** mines of France, Belgium and Poland. Therefore a large portion of their coal, ore, and other supplies cost them nearly nothing. Naturally, a German shell, made with French iron and Belgian coal, cost far less than a French shell made with American steel and English coal. As a result, the net price of the greater part of German munitions is much lower than that paid by the Allies.

Then Germany had the advantage of a central position. She could move her supplies to the different **CENTRAL** fronts more easily than the Allies. **POSITION** By the conquest of the Danube, the Germans could reach all their fronts easily. It is evident that it cost less to send a shell from the Krupp factory to any part of the German front than it did to send an American shell to France, or a Japanese shell to the Polish front, or a French shell to Roumania, or an English shell to the army operating in Mesopotamia. An American shell has to be handled four times, once at the munition plant, once at the port of shipment, a third time at the French seaport and a fourth time at the front, while a German shell

can be sent direct from factory to front without any intermediate handling. It is clear, also, that the cost of transporting a soldier to any one of the battle fronts was very much less for Germany than it was for the Allies to transport soldiers from Australia and America.

Thus, it can be pointed out that Germany was carrying on the war much more economically than the Allies. It is perhaps fair to say, that if France spent 150,000,000 francs for war material, Germany for the same amount of material would spend no more than 100,000,000. If France spent 30,000,000 francs, Germany would spend only 20,000,000 francs, and what was true of France was true to a greater extent of the other Allied nations.

Germany obtained great quantities of supplies from the territories that she seized in France, Belgium, Serbia, Roumania and Russia. From these territories she enslaved 42,000,000 people, who furnished a vast amount of labor, which was cheap, because the enslaved were robbed in many ways and poorly fed.

By reason of their advance into Belgium, Serbia and Roumania, the Germans took possession of vast stores of war materials, consisting of cannon, rifles, munitions, wagons, locomotives, cars, and thousands of miles of railway, which they made full use of at a very low cost. The Belgian railway system alone was worth a billion dollars.

From all these conquered countries Germany obtained various kinds of foodstuffs. Everywhere, we
ROBBING are told, they stole horses, cattle
CONQUERED LANDS and domestic animals, grain, potatoes and sugar, and food products of all kinds. This included the reserve supply of the countries that she had seized. The harvests were often taken in a large measure, and all of the productive land

was put into cultivation by forced or enslaved people.

In all these occupied regions, the Germans also took raw material, such as coal and iron ore, copper and petroleum and the like, including such metals as bronze, zinc, lead, copper and tin. These were also taken from private citizens. All local supplies on hand were appropriated. They also took textile fabrics, consisting of woolen and cotton cloth, and silk. From the cities of northern France alone the Germans are said to have captured 550,000,000 francs worth of wool.

From this it is easy to see what an immense amount of plunder, amounting to billions of dollars, has been taken by Germany. Then, too, they seized upon hammers, motors, machinery, rolling mills, lathes, drills, electrical engines and the like, and these were transported into Germany. The total value of this stolen material in Belgium and northern France, which are among the richest industrial districts in the world, is beyond computation.

In all these regions the Germans also imposed war taxes, called imposts. Belgium is staggering **TAXING THE CONQUERED** under an annual war tax of nearly 500,000,000 francs. Bucharest, after it was conquered by the Germans, was forced to pay a levy amounting to nearly 2,000 francs per capita of the whole population. These are merely illustrations of the taxes that Germany has assessed upon all the subject people where her armies were in possession. In Poland, the German government printed billions in paper money and forced it upon the people. They were compelled to sell their products for this paper money, which amounted practically to confiscation.

In September, 1916, the Germans seized nearly a billion francs from the National Bank of Belgium in Brussels. This was later taken to Germany. At

Noyon, France, the Germans broke open and pilaged the safes and banks of private businesses before retiring from the town. The securities, jewels and silver plate at Noyon represented a value of about 18,000,000 francs. These are only incidents, but they illustrate what Germany has been doing throughout the conquered regions. The total plunder has mounted well up into the billions of dollars.

Then Germany has bound her allies to her by forcing them to borrow money from her. She has **GERMAN** loaned billions to Austria, Bulgaria, and **LOANS** Turkey; and they in turn have spent this money in Germany for their war supplies. When the war is over these nations will, therefore, be so deeply indebted to Germany that they will be her vassals. Thus, by use of paper money, Germany has made her allies dependent, and at the very same time has obtained troops, foodstuffs, and raw materials without which she could not have carried on the war. These obligations are already weighing so heavily upon Austria-Hungary, Bulgaria, and Turkey that they are in sore distress. They are so deeply in debt that no one of these countries can ever hope to pay it off, unless a victory of the Allies should remove from their shoulders that financial yoke of Berlin.

The food crisis in Germany led Berlin to proceed with great haste to get the use of the rich farming **FARMING** districts which the fortune of war put **ABROAD** within her grasp. Hundreds of experts, with thousands of agricultural implements, were sent to Roumania, Serbia and Asia Minor. There were two districts especially which were early given attention. In one, cotton growing was developed and in the other intensive cultivation of grain was in progress. By getting possession of these rich farming regions, Germany will bind these nations

to her by starvation, if by no other way, because she will seek for herself the productive areas which ordinarily afford the food supply for the natives of these countries.

Germany has gone forward with great speed during the war in binding this Mittel-Europa together. The factories for making war materials have been distributed through the whole territory, with the double object of making use of raw materials near their source of origin, thus avoiding useless transportation, and of shortening the distance necessary to send munitions to any threatened sector along the front. For this reason the Krupp firm, at the outbreak of war, established a munitions factory, not only in Bavaria, but also in Bulgaria and Turkey.

The railway system and the strategic automobile roads in the central European countries have developed very swiftly, especially in **TRANSPORTATION ADVANTAGES** the Balkans and in Turkey, where the need was very great. In fact, on every military front a railroad running parallel with that front was built, so that reinforcements might be sent to any point with a maximum speed. All these, taken as a whole, have raised Germany's natural strength to gigantic and powerful proportions. If the Kaiser's armies were to withdraw from Russia, Poland, Belgium, and France, Germany would still include 150,000,000 people in Mittel-Europa from which they could draw 30,000,000 soldiers. All this is possible through the carrying out of the Hamburg-Persian Gulf Railway.

It is plain that if Germany were to succeed in splitting Europe in two, her trade advantages and **GERMANY IN RUSSIA** military pressure toward the east would be irresistible. The countless German representatives which Berlin already maintains in the vast territory of Russia would find their work becoming easier every year, and Russia would break

up permanently from the Baltic to the Pacific into a series of little German-ruled countries. This has been the plan of Germany and it is already fairly well carried out. Just now, there is nothing to prevent Germany's influence from becoming the controlling force in opening up the immense natural riches of Russia, both Russia in Europe and Asiatic Russia.

If Germany can carry through this scheme, she will have another advantage. There are twenty-one billion francs from these different countries which are owed to France. The German plan is to have these different nations under her control give over these debts to her, and she will charge them up to France as part of the immense war indemnity which she thinks she should have.

All of these plans, of course, depend upon Germany's winning the war. Now that the Pan-German **FRENCH** scheme has, for the time being at least, **LOANS LOST** been accomplished, we must say that twenty-one billion francs of French money, at the lowest estimate, represented by French loans to Russia, Austria-Hungary, Serbia, Bulgaria, and Turkey have been virtually seized by Germany. This, taken along with the terrible losses of France during the four years of war, will almost ruin that country, unless a decisive victory of the Allies shall yet rob Germany of her spoils and guarantee to France that she shall have not only the money loaned to these other countries, but that she shall be paid a war indemnity by Germany.

There are also serious disadvantages to fall on Germany's shoulders because of the war. She has **GERMAN** lost millions annually from foreign trade, **LOSSES** she has lost hundreds of her splendid merchant ships, but above all, she has lost the goodwill of the civilized world. Her prosperity rested

on her foreign trade. She cannot sell her volume of manufactured goods to herself. World hatred will prevent Germany from regaining her trade supremacy for many years. This will bring hardship and poverty to the Fatherland.

CHAPTER XIX

THE WORLD'S COAL AND THE WAR

The coal industry is one of the foundations of civilized life. Not only does mankind need millions of tons of coal to heat homes and dwellings, but other millions of tons are needed in the multitude of factories and in the public service plants throughout the world where electric power is produced. Wherever heat is used, coal is needed, except in the small ways where wood is used as fuel and where oil is abundant and cheap.

In days of peace we were wont to look upon coal as one of the necessities, but our supply was sufficient and we gave it very little thought. Coal came to us then as a matter of course, but when war began these things were all changed. The warring countries had to have so much more coal for their fleets and factories and war munition plants that the world suddenly realized that it was short of fuel.

The United States is the largest coal producing country in the world. It furnished before the war about thirty-eight percent of the world's supply, while Great Britain afforded twenty-two percent and Germany twenty percent. These three were the chief coal countries; following them, were Austria, France, Russia, Belgium, and Japan, all of which produced far lesser amounts.

Of all the large countries, France's coal supply was hardest hit by the war. France was never able to supply sufficient domestic coal for her own requirements. While she pro-

duced before the war forty million tons, she was in need each year of sixty million tons. This shortage of twenty million tons was imported, mainly from Great Britain; a small amount came from Belgium and from Germany.

When the war broke Germany seized the northern sections of France and took possession of sixty-eight percent of the coal supply of that country. In spite of everything that France could do to increase her supply, she was still short one-half of her normal need. During the war nearly all her imported coal came from England. In 1914 and 1915 the fuel situation in France was not serious, but by the following year the demand for coal increased tremendously, both from the munition plants and private industries, and the mounting price of coal was alarming. The heavy loss of the northern coal mines, the increased demand, and the very high freight rate for imported fuel caused the price of coal at the mines to increase seven times over what it had been before the war. The result was great suffering on the part of the small consumers throughout the country of France. So great was the need that the government was forced to take over the coal supplies and to deal them out according to the needs of the people and of the different industries.

The German coal industry had been well organized for several years before the war began, but **GERMANY'S GRAB** during the war the production of coal in Germany was wholly unequal to her ever-growing demands. However, by occupying Belgium, she seized large coal mines, as well as those in Poland and in northern France, and these added millions of tons to her coal supply. She was therefore able to export small amounts of coal to Switzerland, Holland, and the Scandinavian

countries in exchange for other supplies of which she was in serious need.

In such neutral countries as Sweden, Norway, Denmark, Holland and Switzerland, the coal situation became more and more difficult in the **NEUTRALS SUFFER** course of the war. The countries are almost wholly dependent upon Great Britain and Germany for their supply, but neither of these countries could furnish them with anything near enough. The manufacturing industries of these countries were seriously paralyzed. There was widespread suffering on account of the fuel shortage. It was only by very careful and earnest pleading for exchanges that these countries were able to get even a limited fuel supply.

In Sweden the fuel situation was so critical that the government took over all combustibles, including coal, coke, wood, and benzine. Coal and coke cards were introduced in Sweden, but even those who had cards could get only one-seventh of what they used before the war. Owing to the scarcity of coal, many railways and steamers were forced to burn wood.

Russia, like France, lost some of her largest coal producing districts to Germany. The great coal **RUSSIAN IMPORTS** regions in Poland produced about seven million tons a year. Some of the Russian coal fields even reduced their output during the war so that they were producing less than half of what they should. British exports of coal into Russia went to the Baltic ports and the Black Sea, and the closing of these ports increased the coal shortage of Russia. Throughout the country oil, wood, and peat quite generally replaced coal.

The Italian coal situation became acute as soon as that country entered the war. Formerly Italy got **ITALY'S FLIGHT** the greatest portion of her coal supply from Germany, but during the contest Great

Britain was called upon to supply the bulk of Italy's coal, the imports of fuel amounting to about ten million tons a year. In 1916 the United States began exporting coal to Italy, but high freight rates and a shortage of ships resulted in exorbitant fuel prices, and Italy was in great danger of suffering. In fact, her munition industries were forced to close for a time because of the shortage of coal. It has been said that this was one reason for the Italian defeat before the combined armies of Austria and Germany in the year 1917*. Prior to 1914 not much coal was produced in Italy, but in 1916 she operated one hundred and forty-eight coal mines, as against only fifty-nine the year before. A great deal of this, however, is of inferior quality.

The coal situation in Canada during the war was very much like that of the United States. There **CANADA** were difficulties of transportation, short-
IN WANT age of coal, and high prices in the chief centers. This was caused largely by the fact that the provinces of Canada have been depending upon the coal fields of Pennsylvania and Ohio for their supply. Notwithstanding the enormous fuel resources of Canada, over one-half of the coal she uses has been imported from the United States.

Very little coal is produced in South or Central America. There are small fields in Chile, with a **ENGLISH COAL IN** limited annual production, but this
SOUTH AMERICA is not sufficient to supply the needs of these countries. Coal fields have been discovered in Bolivia, Colombia, and Brazil, but they have not been developed on a very large scale. In the past, most of the coal imported into South and Central American countries came from Great Britain. England's coal is of excellent quality, her shipping facilities are superior and well organized, and the freight rates low. All these advantages enabled

*See "World War," Chapter 24.

England to control the coal exports to these countries.

During the war the British exports to South Atlantic ports were greatly reduced on account of the shortage of ships. America has taken over the coal trade to South America. This promising beginning will in the course of time develop into a good export market for our coal. But at present the South American countries have a serious coal shortage. Many of their industries had to cease operation, and private homes were put to great discomfort. The governments of these countries urged the people to use wood and oil for fuel purposes.

So short was the stock of coal in Argentine that they made a law allowing the merchant steamers **REMEDIES FOR** leaving Argentine ports for overseas **SOUTH AMERICA** destination to take away only as much coal as was needed to reach their first port of call in South America. The coal shortage in Argentine and Brazil caused the railroad companies of those countries to substitute fuel oil, which is imported from Mexico, on their locomotives. In Brazil the government has made large loans to the railroads and coal mining companies to stimulate the development of that country's resources.

So great was the increased demand for coal the world over for war industries and merchant fleets **CAUSES OF** that everywhere there was a coal famine, **SHORTAGE** even in the United States, which now supplies nearly half of the world with coal. When the different countries entered the war, most of them allowed their miners to enlist, or else drafted them, leaving the coal mines short of expert labor. This mistake was made not only by Great Britain, but by Germany and by Canada. The consequence was a decided falling off in the coal production. It later became necessary to send thousands of enlisted miners back to the mines.

In the United States, thousands of men left the coal mines for more lucrative employment in munition factories, where the scale of wages was about one-fifth higher than it was in the coal fields. To prevent the miners from seeking employment elsewhere, it was necessary to raise their wages. This increase in wages took place in practically all of the leading countries in the world. Nevertheless, there was much unrest and numerous strikes among coal miners of Great Britain, the United States and Germany.

On account of the shortage of cars to carry the coal away, many mines had to shut down for a time. Thus, there were fewer working days. Then, too, there was a heavy increase of accidents in the mines, due to inexperienced laborers that were being put to work, and to the fact that the management was less careful in order to speed up the production.

But, although it was hard to get the coal, perhaps the most difficult problem to overcome was that of transportation. The difficulties of carriage by rail and water increased so rapidly during the course of the war that the whole question of supplying the world with coal depended largely upon adequate shipping facilities. This break-down in transportation took place in all the countries, including Germany.

It was the serious railroad congestion that caused the shortage of coal and the suffering in the United States in the winter of 1917-18. In many countries, including America, there was a limit placed on the number of passenger trains in order to relieve the freight congestion. Enormous quantities of coal remained at the mines for days because there was not enough rolling stock.

One of the means of relieving the railroads of congestion was the scheme of zoning a country. Zone

COAL ZONES systems were put into operation in Great Britain, the United States and France. The countries were divided into areas or zones, and all factories and homes in these particular zones were forced to obtain their coal from the home zone. There was no shipping of coal from one zone to another.

A further scheme for saving the railroads was to use canals and rivers for shipping coal. Thus canals **WATER** were used in America and Europe to a **CARRIAGE** greater extent than ever before. The people of these countries were urged to buy their coal during the summer and store it, so that there would be less danger of traffic congestion due to rush orders during the winter months.

So critical was the coal situation in most countries of the world, that in most places the governments **GOVERNMENT** were compelled to take over control **CONTROL** of the mines and direct the distribution of coal. They took charge of wages and established a rate that would pacify the miners. In order to get the proper distribution of coal it was found necessary in many cases to take over also the control of the railroads. This was new in America. But in most of the other countries the governments already had a greater or less control over their railroads.

One of the best effects of the war upon the coal industry in the United States, Canada and Great Britain, was the powerful stimulus that it exercised on the by-products of the coke industry. The war forced the American people to realize their dependence on continental Europe and on Germany in particular for the by-products obtained in distilling coal, especially for dye-stuffs.

Up to a few years ago, the United States was the most backward of all great nations in the manufac-

COAL-TAR PRODUCTS ture of coal-tar products. Since 1915, all this has changed. The old bee-hive oven for making coke was gradually supplanted by by-product ovens to such an extent that in three years the by-product coke production practically doubled. There was as much gained as in the previous twenty years. Thus there was a great force brought to bear on the chemical and manufacturing industries by the supply of such an abundance of raw material from the new coke plants. One of the most valuable of the results of the by-product industry is the conservation of our coal supply. It is estimated that the ovens put into operation during the last three years will save annually to this country, fuel equivalent to five million tons of coal.

In Great Britain the recovery of by-products is actively encouraged by the government, with a view to future extension of this industry on a large scale. The government has a fuel research board to investigate the problem of replacing the greater proportion of raw coal now used by the substitution of various fuels obtained from coal after the by-products have been extracted. It now realizes that the by-products of coal are an invaluable source of wealth which has been shamefully neglected and which must be saved by patented recovery coke ovens.

Prior to the war there was a steady increase of British foreign coal trade over that used at home, **BRITAIN** but the war has completely changed **LOSES TRADE** this. Much more coal is now used in England while her shipments abroad have greatly decreased. There are two reasons for this change. The first is that Great Britain's war industries needed a great deal more coal at home, and the other, that the submarines had sunk so many ships that they could not spare vessels to carry the coal to other countries. Many British ships had to be

called from other lines to keep the line between England and America supplied. America did not need coal and thus British coal exports were reduced nearly one-half from 1914 to 1918.

The war has brought about great changes in supplying ships with coal. While Germany has lost a few coaling stations in the East, the Dutch have won new markets. In the Far East, Japan coal has supplanted British coal in many places, and on the entire northern Pacific coast of Asia, Japanese coal is now used. The chief Japanese coaling parts are Yokohama and Nagasaki. All coal burning steamers crossing the northern Pacific Ocean now use Japanese coal.

The war has also built up the American bunker coal trade on the Atlantic. The excellent coaling **AMERICA'S** facilities at Panama and Colon give the **GAIN** United States complete control of one of the most important coal supply depots of the world trade. American bunker coal has supplanted British coal to a very large extent in the South American stations.

Thus it is evident that English commerce which depended upon the coaling stations and bunker coal exports has been weakened during the war. It is a question as to what extent Great Britain may regain her overseas coal market after the war. The quality of British coal is good, and this may decide in its favor.

On the other hand, greatly increased production in America and a large fleet of newly built coal-carrying vessels may make this country the leading coal exporting country of the world. Another factor which will help put the United States in the lead in exporting coal, is that our facilities for loading are superior to that of any other country.

CHAPTER XX

GERMANY'S COPPER FAMINE

In this war metals are playing a very important part, especially steel and copper. One can hardly say of copper, as one can of steel, that it furnishes the base for the whole mechanism of the war, but one can say that copper holds the second place.

Every rifle cartridge-piece holds nearly half an ounce of the purest copper. Every bullet that flies **COPPER** from the machine guns has been enclosed in **IN WAR** a casing of copper and zinc, gas tight and exact to a five-hundredth part of an inch. Every shell that is fired, whether shrapnel, high explosive or armor piercing, is encircled with a copper band to prevent contact between the shell and the gun barrel. In every fuse copper forms a part. It is also in gun metal. For field telephones nothing else will do, as anything that is operated by electricity must have its copper parts.

Copper enters into our lives in a hundred different ways on which the average man never wastes a thought. It is used in every article of brass and of bronze that we use. Wherever there is electricity, copper is an essential element. There could be no electrification of railways without plenty of copper for cables and fittings. All the telegraph and telephone wires the world over are made of the red metal. It is the best conductor of electricity that has so far been found. Experiments have been made with aluminum, but as a conductor it has not been found either as economical or as lasting as copper.

Then, to get some idea of its manifold uses and

importance, one may think of boilers, stills, cooking vessels, seamless pipes, nails, wire, **USES OF COPPER** etching and engraving plates, lightning rods and writing pens that are made of copper. If the supply of copper were to run short, we should be put to great loss and inconvenience because of it.

Our forefathers would not have minded the prospect of having to get along without copper. A hundred years ago an output of less than 10,000 tons a year was sufficient for the needs of the whole world. Nowadays we consume over a million tons annually.

For the first seventy years of this century the average annual consumption was no more than **AGE OF** 32,000 tons. Then came the dawn of **ELECTRICITY** the electrical age and with it the greatly increased demand for copper. From 32,000 tons a year the demand rose to 240,000 tons. During the first decade of the present century it increased still further, to about 700,000 tons a year. In the years since 1910 it has averaged over a million tons.

The demand for copper was increased by the war, but was not caused by it. It has been growing continuously and at times amazingly during the past forty years, and it is based upon the industrial development with the new uses that have been found for electricity. The increased demand for copper would have gone on if there had not been war. The war has, however, greatly increased its production and at the same time has diverted a great deal of it from industrial to war uses and has drained the sources of supply, especially among our enemy countries.

Before the war Germany was producing from her own mines an average of 26,000 tons of copper a **GERMANY'S** year. In normal times she required **SHORTAGE** 250,000 tons of copper annually. Thus she needed from abroad about 200,000 tons a year in

order to keep her industries going and to keep her exporting factories well supplied. Since the war began it is difficult to see how Germany gets along with less than 125,000 tons of copper a year though she has restricted the domestic use of it. It is hardly probable that Germany obtains five times as much as she ever secured from her own mines. For the past four years, therefore, one of Germany's greatest problems has been to make good an annual shortage of at least one hundred thousand tons of copper.

How far Germany has succeeded in obtaining the required amount of copper we do not know, but the **RESERVES OF COPPER** methods she has adopted in attempting to supply it are now fairly familiar. First, she drew on her storehouses. There cannot be much doubt that, having planned the war, Germany had gathered together in advance great stores of copper. For five years before the outbreak, she was an unusually heavy buyer of the red metal. It has been learned that during that period she imported yearly 200,000 tons of copper more than she used in her manufacturing and export business. Just how much reserve copper she had on hand in August, 1914, one cannot tell, but it was unquestionably large enough to supply the demands of a brief campaign, which was all that Germany counted on.

During the early years of the war Germany imported all the copper she could obtain from border-**GERMAN COPPER IMPORTS** ing neutral countries. In September and October of 1913, Italy, Holland, Norway and Sweden imported something less than 5,500 tons of copper. In the same months of 1914, after the war had started, they imported 26,000 tons, and there can be little doubt that some part of it, and probably a great deal of it, went into Germany. The British blockade at that time was rather poorly enforced and there were a good many

kinds of manufactured articles which had a large element of copper in them, even as much as 70 per cent, that were not contraband.

American copper dealers were anxious to furnish Germany with copper, and England did not want to injure America's trade, so that, doubtless, considerable copper reached Germany from America. Even before the end of 1914, anyone who could land a ton of copper in any form across the German frontier could get for it eight hundred dollars paid down in gold. This was forty cents a pound and perhaps twice as much as copper was selling for in the open markets throughout the world. However, Germany's supply from neutral countries was at last practically cut off.

Then the German government relied upon the patriotism and self-sacrifice of the Germans at home **STRIPPING** and of their friends abroad, to supply **THE EMPIRE** it with the copper that was needed. The government at once took steps to get hold of as much as possible of the copper in domestic and manufacturing use in Germany. In Hamburg alone in 1916 there were twenty-nine agents for collecting copper utensils. In January of that year the entire population of the German Empire was commanded to surrender all articles of copper, brass and nickel. Since then the empire and all the territory of her allies and the conquered regions have been gone over with a fine tooth comb in the search for the red metal.

The fifty-four castles and residences that belong to the Kaiser, as well as the opera houses and theatres in which he was interested, have **COPPER** **ROOFS TAKEN** all been ransacked for the precious metal. Even publishers had to give up their copper faced "blocks." The cable tramway at Kiel and many other towns were torn up for the copper to be gotten from them. The cathedral at Bremen was

stripped of the copper in its roofing. Church bells have been generally confiscated. Even cemeteries have been searched for crucifixes, crosses, and medallions that contained copper. The holy water basins in Belgian churches have been taken.

Householders were urged at first, and then ordered, to hand over all copper saucepans, kettles, cauldrons, boilers, cooking utensils, door-knobs, bed-warmers, coffee machines, ash-trays, chandeliers and other copper ornaments that they had in their possession.

Public statues in bronze or copper in great numbers were melted down. Late in 1918 the German authorities turned their attention to public buildings with copper roofs. Among the scores of places stripped were the famous Brandenburg gate, Prince Albrecht's palace, a dozen churches and synagogues, and several museums. Some of the best known hotels, restaurants, and department stores and also private mansions were forced to give up their copper roofs.

German agents have been active outside of the Fatherland on a busy search. They were found in **BUY QUEER** faraway Persia buying copper and **ORNAMENTS** bronze guns. In neutral countries they bought up copper coins by the bushel. The very herdmen's huts in the Swiss hills and valleys were visited by German agents, looking for stray copper utensils. Prisoners in German camps were ordered when writing home, to ask the oddly innocent gift of a copper saucepan.

All sorts of machinery were purchased by the German government in the adjoining neutral countries, provided that one-third of the tool was made of copper. They even gave orders to the Scandinavian countries for copper lamps and copper motor accessories, which were wanted only for the copper in them. The dealers in Denmark were

startled one morning by an order for a million copper plates with the Kaiser's portrait engraved on each, which were to be shipped to Germany as works of art.

Neutral countries which were neighbors of Germany very early in the war forbade the exportation **SMUGGLING** of copper from their territory. Still **COPPER IN** there was a great deal of smuggling going on all the time. Copper leaked over the frontiers under many disguises. The Danish tried to run forty tons of it as sugar, but the game was stopped when the bottom dropped out of one of the casks. Five Dutchmen were arrested on one occasion when it was found they were trying to smuggle copper under the cargo of a Rhine boat. Railroad cars coming from Sweden to Germany were found equipped with double sides for concealing copper.

The British blockading squadrons found copper buried in orange boxes from Spain and in hollow logs, and candlesticks. They captured steamers whose names were written in copper letters a foot long. They found copper in bales of salt and wool, in bags of corn and linseed from South America. On one occasion they seized 200 packages of copper which weighed five pounds each which German sympathizers in the United States had sent by first class mail to their friends in the Fatherland as Christmas presents.

When Germany sent her U-boats to the American shores in May, 1918, they were evidently instructed **U-BOAT COPPER** to bring back some copper for their **VICTORY** urgent needs at home. After destroying a number of vessels the U-boats captured one that was bringing copper from South America, and the story is told that the U-boat took off seventy tons of pure copper from this boat. A few days later a submarine was seen 300 miles from our shores making its way to Europe. It made no at-

tempt to disturb the ships that it passed, and it was surmised that this U-boat was carrying the seventy tons of red metal to Germany.

All these desperate tricks tell their own story. Germany, the greatest copper importer of Europe, **COPPER** is now almost barren of the red metal. **SUBSTITUTES** Early in the war German scientific men were set to devising substitutes for copper. As early as April, 1915, the Allies picked up on the battle field many German fuses made, not of copper, but of aluminum with a small copper wire. They were not very successful. The shells, being over light at the point, fell sidewise and failed to explode. By other means they may have had better results in the search for alloys to take the place of copper, but we shall have to wait until the end of the war before the success of their efforts is known.

Meanwhile the capture of some Serbian copper mines relieved the situation. The Germans, after conquering Serbia, sent thither at once 6,000 miners with great publicity, so the German people might feel confident that the copper famine was over. But Serbia could not long relieve the situation, for it produced only 7,000 tons a year prior to the war, and the machinery with which this was done was largely destroyed before Germany got control of the mines.

Before the war nine-tenths of Germany's supply of copper came from America. They had some **AMERICA'S** copper coming from Australia, Belgium, Japan, and Serbia and Great Britain. These are all now enemy countries. If the Allies, when the war is over, care to use this powerful weapon, they have a monopoly of such raw materials as copper and cotton upon which Germany has built up her export trade and her manufactures, and they can ruin the Fatherland by refusing to sell her these indispensable raw materials.

The condition that prevails in Germany prevails also among her allies. The end of the war will find areas in Europe and Asia Minor inhabited by a hundred and fifty million people that are practically without a pound of copper. Germany has overrun and despoiled wide territories belonging to our Allies and taken from them all the copper available, so that there will be a copper famine throughout middle Europe when the war ends.

Copper is found in a greater or less amount all over the world's surface. There are believed to be supplies of it both in the Arctic and Antarctic regions. It is being mined in central Africa, the United States, Spain, Chile, Australia, Japan, Russia, England, Scotland and Wales. The countries are few where it does not appear in greater or lesser quantities.

On the other hand, countries are fewer still where the beds easily accessible and rich enough to have **WORLD'S** any effect upon the world's supply. There **SUPPLY** are today some 335 copper mines working, but more than half of them produce less than 500 tons apiece yearly. Not far short of 60 percent of the total copper production of the world comes from the United States. This is one of the most important facts of the copper industry. A few big mines are responsible for about a third of the American output, and their known reserves, at the present rate, are not likely to last more than twenty years. After the war America will control the supply of the entire world unless there are fresh sources discovered elsewhere.

All over the earth men are prospecting for new deposits and they are even opening mines that have **PROSPECTING** been abandoned. Especially in **FOR NEW MINES** Great Britain the hunt is on. The only country from which relief can be expected is Russia, which stands today, from the copper stand-

point, just where the United States stood thirty-five years ago. Russia possesses vast copper deposits, needing only railways and capital for their development. Doubtless this development of Russian copper mines will take place; but for the present Russia is an empire greatly distracted and unable to give a thought to her hidden mineral deposits. It is too much to expect that her vast wealth of copper and other minerals can be had in time to save the world from a terrible shortage in copper when the war ends.

CHAPTER XXI

PLATINUM AND THE WAR

One of the metals that is essential in making war is platinum, and there is a dangerous shortage in the platinum supply. Without it the manufacture of high explosives in great quantities for shells and for other purposes would be greatly hindered, if not altogether impossible. It is used in the manufacture of nitric and sulphuric acid, which are the two great essentials in the making of high explosives, and there is nothing that can be substituted for it without great inconvenience.

A platinum process plant for the manufacture of sulphuric acid can be built in six weeks. To build **PLATINUM** a similar plant using a lead chamber **IN WAR** process would require a year, and there is not sufficient lead to turn out the quantities of acid needed. Moreover, the acid made from platinum is much superior.

There are many war machines where platinum is the only metal that can be used in certain parts which are necessary to secure perfect control. Each telephone and telegraph instrument has platinum contacts. Every high grade magneto for airplane, automobile, motor-boat or gas engine has from two to six contacts of platinum. There are multitudes of contacts on the telephone switchboard and on relay instruments of both the telephone and telegraph lines that must be of platinum. It is required also in the new plants our government is constructing with such feverish haste to take nitrogen from the air for fertilizer and munitions. Platinum is also

much used for delicate surgical instruments and for X-ray tubes.

Platinum was known to the ancient people of Ecuador who made ornaments of it. These have **QUALITIES OF PLATINUM** been found in excavations. It was appreciated for the beauty of its color effect in combinations with gold. Until recent times platinum had not been much used because it is difficult to melt or liquefy. Then, too, it cannot be dissolved in the common acids as other metals can.

One of the qualities of platinum that makes it so necessary in industrial work is its marvelous ductility. Out of a single ounce of platinum it is possible to make an unbelievably slender wire that would reach about 1,800 miles. To draw out platinum into such an extremely fine wire, it is covered with a thin layer of gold, and drawn to a fine thread. Then it is covered again with gold and drawn to the thinness of the former one and the gold dissolved away. After repeating this process several times with short sections of the wire, it is still unbroken but almost invisible.

With the great progress of industry in modern times platinum has come to be used in many branches of mechanical and chemical lines, because of these very unusual qualities.

Before the war the platinum supply of the world was used in about equal amounts for dentistry, for **PLATINUM** scientific purposes in chemistry and **IN PEACE** manufacturing, and in jewelry. The war demand changed all this. So important is platinum in waging war and such a shortage existed that Congress early limited the use of it under license. Dentists and jewelers can now get but little, and for that the price is almost prohibitive.

In the twenty-five years before 1900 platinum sold for six dollars an ounce. By 1900 the price had risen to fifteen dollars an ounce, or about three-

fourths that of gold. Just before the war it cost twice as much as gold. Now the price is over a hundred dollars an ounce, and but little is to be had at that price, as the most of it is required in war work. If our government is forced to commandeer the platinum in jewelry, it is said that it will cost to collect it from \$500 to \$600 an ounce.

For years the world has obtained nearly all its supply of this precious metal from the Ural Mountains, the continental divide between Russia and Siberia. Over 90 percent, and possibly 95 percent, of the world's output came from this source. The United States formerly obtained one-tenth of its supply from Colombia and the rest from Russia.

The platinum mines of Russia were first discovered in 1875, when men were prospecting for gold.

RUSSIA'S MONOPOLY The mines extend for two hundred miles north and south, almost along the backbone of the Ural Mountains. The placer mines here resemble gravel beds. The gravel deposits are comparatively shallow, few of them being over thirty feet deep. The richest gravel is found on or near the bed rock. Gold and platinum nearly always occur together in these gravels. Platinum is now mined only from gravel.

As platinum has no affinity for quick silver, the amalgamation process cannot be used in recovering it. It is caught by washing the gravel on **CRUDE METHODS** the tables of dredges or in sluices, or in methods like the American gold pan. The Russians waste much of the precious metal by crude methods. Before the war, peasant miners—men, women and children—carried on this work in winter in bench gravel pits. They needed no pumping machinery and the windlass was their slow and hard method of hoisting the gravel.

Obtaining platinum by dredging, such as was used to get the gold in the sands and soil of California,

is a most promising field. There is said to be very few first class dredges in the Urals.

The Russians have always used wasteful methods of mining. The war has called for a much greater supply, while the Russian revolution and the acts of the Bolsheviki have greatly reduced the output. The Russian peasants now have more troubles than ever before. There is little desire to work and the output of platinum is more reduced than ever. Moreover, if Germany continues to fasten her grip upon Russia, as she was doing in 1918, she will cut off all this source of supply from the Allies.

Our country is now desperately in need of platinum and will be for many years. It is believed that aside from the large amount in the form of jewelry, a great part of which is in private ownership, there was on hand in our country in 1918 only one-fourth the usual amount of unmanufactured platinum. Patriotic people will refuse to buy jewelry containing platinum while the war lasts.

CHAPTER XXII

NITROGEN FOR FERTILIZER AND MUNITIONS

When the war opened there was much concern over the problem of securing nitrogen, especially in Germany. There is an abundance of nitrogen in the world, but it is difficult to obtain it. The atmosphere is made up of nitrogen to the extent of 80 percent, and there is much nitrogen in the soil. So, while there is plenty of nitrogen all about us, it is usually mixed with other elements and we have a difficult problem to separate it.

Men and animals must have nitrogen in their food and they get it from the plant world. Plants in **SOIL** turn get it from the soil. After a number **HUNGER** of crops have grown on the same land the soil has yielded much of its nitrogen supply, and then the crops suffer. For a long time men did not understand why the crops on old land were so poor.

About a hundred years ago a Scotchman living in Chile took some nitrate, which is a compound containing nitrogen, found in the desert there and sprinkled it over a part of his garden. To his amazement that part brought him a splendid growth, while the rest failed to yield a good crop. He did not understand the reason, so he sent some of the nitrate to Scotland, where it was analyzed. In this way the value of nitrogen as a plant food was discovered.

Now farmers everywhere know that crops take nitrogen from the soil and it must be put back in

FERTILIZING the form of nitrate fertilizer or the **PROFITABLE** crops fail. It has been found, for example, that old wheat land that is yielding only 20 bushels to the acre will grow 30 or more bushels if the soil is fertilized by spreading nitrate over it. Potato land can be improved with nitrate from 130 bushels per acre to 200 bushels or more.

Chile, which occupies a narrow strip along the western coast of South America, has what is called a natural monopoly of nitrate. This means that the nitrate deposits here are so much greater than that of any other country that everybody who needs nitrate imports it from Chile.

The deposits occupy a belt of land about 500 miles long and 10 miles wide lying about 15 miles from the **NITRATE** seacoast. This is a desert region and **DEPOSITS** there is very little rainfall to wash away the nitrate. The raw material called "caliche" is not hard to mine, because it is close to the surface of the earth. The deposit is from one to six feet thick and is in some places within a few inches of the surface. In other places there are layers of dust and rock some 25 feet thick over the deposits.

The deposit contains not only nitrate, but other substances, such as salt, borax, and iodine. It is broken up by boring into it and exploding a charge of gunpowder. The broken pieces are then crushed and carried to great tanks, where boiling water is used to dissolve the nitrate and separate it from the other substances.

Since there is no water in this desert region, they obtained water in early days by bringing salt water from the ocean and distilling it. Sometimes fresh water was brought in ships. Now these expensive methods have given place to pipe lines which bring fresh water from the distant Andes Mountains.

After the boiling water has taken up as much nitrate as it can dissolve, it is drawn off into other

READY FOR MARKET tanks to be purified, and finally into still other tanks, where a part of the water evaporates and the nitrate turns into crystals that look like rock salt. It is then shoveled from the tanks into cars and allowed to dry for several days. The pure nitrate is then packed in bags to protect it from the air, for it will absorb dampness very rapidly. It is now ready to be shipped to the ends of the earth, to be exchanged for the articles of food and clothing that the Chileans cannot produce at home.

Before the war all the nations of the world were importing nitrate in great quantities from Chile. Germany was using 600,000 tons of nitrate each year for her farms and it all came from this same source.

The other use to which nitrate was put was the manufacture of nitric acid, which is one of the most **GERMANY'S NEEDS** powerful acids known to chemists. Nitric acid is widely used in manufacturing, but it is especially necessary in making high explosives. It takes from 3 to 10 tons of nitric acid to make one ton of explosive. Before the war Germany was using 300,000 tons of nitrate each year in manufactures and in making munitions. After the war was under way Germany was using 400 tons of explosives every day.

Knowing this, the Allies expected by cutting off Germany's nitrate supply from Chile to hinder her making of explosives. Germany had doubtless laid by a huge supply of nitrates for this struggle, but explosives are used on such a tremendous scale in this war that they thought her stores would not last long. Though Germany was counting on winning the war in a brief campaign, still she knew that her nitrate supply from Chile would be stopped by England's superior navy, so she set her scientists and

engineers to the task of obtaining nitrogen from the air and built huge factories for the purpose.

It has been known for years that powerful electric currents would draw nitrogen from the air and **NITROGEN FROM AIR** make it available for fertilizer and munitions. This is an expensive method, but it had been tried at Niagara Falls and in Norway, where cheap water power would furnish plenty of electricity. This method had not been much used before the war because of the abundance of cheap nitrate. But now Germany must have nitrogen no matter what the cost. It is said that German engineers spent a year and a half working day and night equipping the factories for big-scaled production. Millions of dollars were spent. In this way Germany has obtained ample and constant supplies both for fertilizers and for explosives for as long as the war lasts, and has made herself independent of Chile and the rest of the world so far as nitrogen is concerned.

The Allies, who have mastery over the sea, can get all the nitrate they wish from Chile, provided they have plenty of ships in which to transport it. The pirate use of the U-boat by Germany made the Allies tremble for their ships. So many had been sunk that ocean trade was greatly curtailed. The United States, fearing that ample supplies of nitrate could not be obtained from Chile, also set to the task of building plants to take nitrogen from the air.

CHAPTER XXIII

AMERICA'S POTASH FAMINE

There are other elements that enter into the fertilizers that farmers use that are very important. **GERMAN POTASH** Without them the crops would soon fail and the world would be short of food. Potassium is one of these. It is generally known by the name of potash. Before the war farmers all over the world were depending upon Germany for their supply of potash. As the German mine at Stassfurt in Saxony was supplying every nation, there was a chance that Germany might try to starve the world by refusing to let any of her potash go out. In fact, Germany had been boasting that through her control of the only known large deposit of potash salt, she would be able to say which nations should eat and which ones should starve.

It was not long after the war started in 1914 until the potash supply of the other nations of the world became exhausted. However, the American people have not yet starved, though we have faced a serious situation.

While potash is one of the most widely distributed of the elements, still every attempt that has been **KILLING COMPETITION** made for the last forty years to produce it in commercial quantities from any of the natural deposits has been blocked, because Germany immediately offered great quantities of potash at prices that made it impossible to compete. In this way Germany ruined every company that entered the potash field.

The standard potash of commerce, or the German

product, used to cost the farmer around forty dollars a ton. Now he can buy only limited quantities of American potash and must pay from \$350 to \$500 a ton. Thus it is evident that America has not yet solved the potash problem.

The United States, in normal peace times, used an average of 250,000 tons of German potash annually **AMERICAN** and the demand has been steadily **POTASH FAMINE** increasing. Had it not been for the war we would probably have used about 500,000 tons in 1918. In the first two years after the German embargo went into effect we had used up all the reserve stock there was on hand, together with a considerable quantity re-exported to us from South America and the price here climbed from \$40 to \$500 a ton. Throughout 1917 we had no potash in America except what we produced ourselves and this in very limited amounts and at great expense.

Potash is usually found in combination with other minerals such as micas, felspar and green sand, and it is difficult to break down this combination so as to set the potash free. These combinations are always breaking down naturally, but not rapidly enough in most sections to satisfy the demands of farming, so the farmer must supply quantities of free potash for his crops.

The sandy soil of the Atlantic seaboard requires potash in larger quantities than nature provides. **SOIL POTASH** The citrus fruits of Florida; the **HUNGRY** ton and tobacco of Georgia, the Carolinas, and Virginia; the potatoes and garden truck of the eastern shore of Maryland and New Jersey cannot be grown in large quantities without potash.

Already the Department of Agriculture is aware that the crops in these sections, where potash was formerly used freely, are showing signs of potash hunger, as farmers can get only a fraction of their normal supply. The crops of 1917 were smaller per

acre and the plants were less vigorous than before. Texas needs no potash for its cotton; Maine can still produce potatoes without it; but tobacco, on the other hand, wherever it is grown, absorbs potash as a sponge does water.

Some of our potash supply now comes from the alkali lakes of western Nebraska and southern California. Some of it comes from Great Salt Lake; some is produced from the alunite deposits of southern Utah. A good deal is obtained from the kelp bed of the Pacific coast, and a rapidly increasing supply is coming from cement works and blast furnaces.

Most of the potash, however, that we obtained in 1918 came from the lakes of western Nebraska.

NEBRASKA POTASH LAKES There are several of these scattered throughout the sand hill region. They have for the most part neither inlets nor outlets, but are merely depressions in the sand in which the surface water and the melting winter snows accumulate to a depth of from six to eight feet. Sometimes a silicate deposit will form a water-tight bottom in one of these lakes and there will accumulate a layer of brine-soaked sand growing richer in mineral contents by evaporation with each passing summer.

Extensive operations have been under way for the last two years to extract the 30 percent potash contained in these brines. The brine is sometimes pumped for several miles through pipe lines to evaporating and kiln-drying plants. From Sevier Lake, alone, 16,000 tons of potash was recovered in 1916, a larger quantity in 1917 and the plant was then enlarged to a capacity of 4,000 tons of potash a month.

Estimates on the life of these lakes vary from four to ten years. While they last and with their product selling at from \$350 to \$500 a ton their operation is very profitable. Without them the

United States would have had very little potash indeed for the years 1917 and 1918.

Probably the largest volume of concentrated potash salt in America is Searles Lake in southern **SEARLES** California. Certainly it is the best advertised, but as yet it is not a very important factor in the actual production of potash. It is rather a dry bed of crystallized salt, hard enough to support a wagon and team and covering an area of about twelve miles with a depth of mineral deposits estimated at seventy feet.

The deposits here carry about two percent of potash and one and three-tenths percent borax. **A LONG** The cost of extraction is very high and the **HAUL** potash thus far shipped is said to carry so much borax as to make it less satisfactory for fertilizer purposes. Searles Lake as a permanent source of potash is handicapped because of the long freight haul, while the whole estimated supply of four million tons would satisfy the normal American demand for only a few years.

There is also potash in Owens Lake in California, Summer Lake in Oregon and many other small similar deposits as well as Salt Lake in Utah. Their total potash reserve, however, is too small and it is too expensive to obtain it by the methods yet applied, for them to be regarded as important factors except during war emergencies.

We are getting a fair amount of potash from the seaweed or kelp on the Pacific coast. About one-**KELP** eighth of our total supply in 1918 came from **BEDS** this giant seaweed. It flourishes in great masses all along the coast as far north as the Aleutian Islands and is extremely rich in potash. It grows close to shore, attaching itself to the rocks at the bottom of the sea and sending out long branches. Some of these branches are as much as two feet in

diameter and a hundred or more feet long and they float on the surface.

Surveying parties were sent out by the Department of Agriculture several years ago; and they reported that the supply was practically inexhaustible. But in our attempts to harvest kelp, it is proved that the density of the growth is very much less than had been believed and much of it grows so close to the dangerous rocky coast that it cannot be gathered. The method of harvesting kelp is ingenious. A submarine mowing-machine cuts the weed off about three feet below the surface, and it is gathered by boats.

There are several concerns actively engaged in potash production on the coast and the Department **DRYING** of Agriculture has put into operation a **KELP** plant near Santa Barbara, California, where improved methods of drying the kelp and extracting the potash salt are to be tried and efforts made to produce profitable by-products.

The fuel cost for drying out the ninety percent of water is so far very expensive. It would be prohibitive in peace time competition. Then there is the heavy freight rate from the Pacific coast to the Atlantic seaboard. Nevertheless the idea of returning to the land potash that has been leached out of the earth and gathered by Nature's own device into seaweed appeals to us all.

One idea is to try to transplant the seed of the kelp along the rocky coast of Maine, hoping that it may flourish there as it does on the Pacific and thus remove one of the most serious items of cost; namely, the long freight haul.

There are plenty of undeveloped potash resources everywhere, when we discover how to secure it. **ABUNDANCE** Nearly half the earth's crust is felspar **OF POTASH** and nearly all felspar contains from five to ten percent of potash, but Germany has been

selling the potash from the Stassfurt mines at such a reasonable rate that nobody until now has had courage to try to develop any new process because there was no profit in it.

There are unlimited amounts of green sand along the south Atlantic coast from New Jersey southward, which is rich in potash. Whether this potash can be extracted at a reasonably low cost remains to be seen. A plant to handle two hundred tons of sand daily has been built. It is expected to produce each day about nine tons of potash.

Near Marysvale, Utah, are deposits of alunite, a mineral containing potash in combination with **UTAH** alumina. From this, potash is being pro-
ALUNITE duced at a cost that yields a profit at present high prices. If the aluminum can be developed as a by-product from this, so as to reduce the cost of potash, it may enable the latter to be produced at a reasonable price.

There is still one other source of potash supply that is very promising. This is the recovery of **NEW** potash from cement kiln and blast fur-
SUPPLIES naces. Cement works and blast furnaces are fairly distributed over the country, so that transportation cost will be low. There is promise that potash from these sources will be abundant for all time. It is too early to claim this has already proved satisfactory, but the evidence so far is all in its favor. Government experts have delved deeply into every phase of the potash question, and they think that this source offers the best chance to compete in price with German potash in normal times.

The process of recovering the potash from the cement kiln and the blast furnace dust has been **COTTRELL** recently discovered and has some very
PROCESS interesting facts. The inventor was looking for something else when he made the dis-

covery. The dust from the cement works spreads all about for miles, carried by the wind, and destroys or injures surrounding vegetation. The orange groves of Riverside, California, were being ruined by cement dust. F. G. Cottrell undertook to find some way to protect the orange groves from destruction. He found that the way to prevent dust from spreading over the countryside was to pass the furnace fumes through a series of charged electric wires, which accumulated the dust at the kiln. Then there was the problem of what to do with the great quantities of dust that was piled up at the kiln by this method.

It has long been known to chemists that limestone, coke, iron ore and clay, which are the ingredients **HEATED** used in cement works, contain potash, **CEMENT DUST** but not in a form that can be easily separated. The dust was analyzed and it was found, as expected, that it contained a very high percentage of potash. But a new fact was also discovered; that the potash had been changed by the heat of the kiln so that it was now readily soluble and could be recovered by simple processes.

This method of extracting potash by means of electric methods is called the Cottrell process. It **POTASH** furnishes at once a solution of the **BY-PRODUCT** problem of dust disposition, which every manufacturer of Portland cement meets with, because laws have made it illegal to discharge dust from cement works to the air; and it also prevents the alkaline potash carried in the fumes from eating out of the lining of the flues. For this reason manufacturers have for years been trying to use as small a proportion as possible of potash bearing ingredients. Now those plants that have installed the Cottrell method find they can add substitutes heretofore discarded and thereby obtain a most profitable potash by-product; and this potash, which is

the important thing, can be produced at a very low cost.

The first plant in the east to adopt the Cottrell method was one at Hagerstown, Maryland. On a production of three tons of potash a day the cost of Hagerstown is thirty-nine cents a unit. Before the war the same quantity of the same grade from Stassfurt sold for eighty-five cents. It is now selling for five dollars a unit in the open market.

The cost of installing the Cottrell process is rather high, amounting to about \$50,000 for a three thousand barrel plant. But as cement manufacturers are forced to do something to control the dust, installations are being made all over the country as fast as the necessary equipment can be obtained. The Riverside plant has been in operation for about four years; that at Hagerstown about a year and a half. There are other plants that are now using a water spray to collect the dust, instead of electricity, and they are producing potash, too.

The annual production of cement in the United States is about 90,000,000 barrels, and the average **POTASH FROM CEMENT KILN** amount of potash that can be obtained would be about one and three-fourths pounds to each barrel of cement produced. Here, then, is a supply of 75,000 tons of potash a year on a basis that will compete with the German product on any sort of terms, and this potash is mainly produced in sections of the country where it is most needed, thus saving the transportation expense.

The blast furnaces of the United States promise a vastly greater supply. They are awaiting only **POTASH FROM BLAST FURNACES** the installation of electric devices. In this industry, as in the cement industry, the main question is one of the necessary equipment. From experiments that have been made, it is estimated that 500,000 tons a year can be produced from the blast furnaces of our country at a

cost at least as low as that from the cement kiln. Large steel companies are now installing the first commercial potash plants.

It now seems clear that sooner or later a very large part of our supply of cheap potash will come from these wasted supplies from the blast furnaces and the cement works of our country. It is believed that these sources of supply will in the end drive out the German product from our markets, and it will be one more justly deserved loss to Germany for starting this terrible war.

There is little doubt that Germany has long regarded the possession of the Stassfurt deposit as **ALSACE DEPOSITS** one of her most valuable pieces on the world chess-board. She hoped to pay a large part of the war cost by making the rest of the world buy her potash at tremendous prices after the war. But in this matter Germany was slightly overconfident. She did not foresee that certain events might defeat her game.

It has been known only recently that potash deposits discovered in Alsace in 1909 are even larger and more accessible than those in Stassfurt. These deposits are actually larger than the Stassfurt beds, according to information recently disclosed by the French. They contain about 1,500,000 tons of potash salt. Moreover, these salts are readily usable for fertilizer without having to be separated from magnesium salts, as is required from the Stassfurt deposits.

These mines in Alsace are located near Wittelsheim. They were first discovered when some deep **ALSACE MINES RESTRICTED** borings were made for coal in that vicinity. The first production of potash from this deposit began in 1910, but, under German government regulation, the amount was carefully restricted. Fifteen mines were opened in Alsace, having a capacity of 800,000 tons a year,

but they were allowed to sell only one-tenth of their total capacity. The German government reduced the production in order to keep control of the potash monopoly.

The Allies hope that Alsace-Lorraine at the end of the war will be restored to France and these potash resources will not only break the German monopoly, but provide France with a valuable export commodity to exchange for the vast supplies of all kinds that she must obtain from her Allies.

CHAPTER XXIV

SULPHUR IN WAR TIMES

A country can fight only in proportion to the amount of sulphuric acid it can obtain. We must have sulphuric acid by thousands of tons or we could not supply our army with high explosives. Sulphuric acid is also necessary in the manufacture of farm fertilizers, the supply of which had to be kept up if we were to feed the world while we win the war.

Sulphur has been known from the earliest time because of its bright yellow color. It is known also **IMPORTANCE** because of the fact that it burns with a **OF SULPHUR** blue flame and forms a pungent gas. It is a chemical element of great importance to man. Entering into the make-up of both vegetable and animal tissues, it is therefore essential to life itself. The small proportion required for the maintenance of life is supplied in sufficient quantities by the soil; but we need large quantities of sulphur in industry, and this supply can be met only by mining in those parts of the earth's crust in which large deposits of sulphur mineral are found.

Without sulphur the manufacture of commercial rubber would cease and in turn the countless articles dependent upon the use of rubber would be destroyed. Without sulphur a great number of chemical industries would be crippled, involving the loss of hundreds of products used by man. Besides explosives, sulphur is needed in the making of paper, medicinal preparation, bleaches, dyes, insecticides and matches. With no sulphuric acid the

manufacture of certain farm fertilizers and many of the explosives, not mentioning a long list of other products, would be impossible. It is therefore an important duty of our government and of interest and concern to each one of our citizens to know the story of sulphur, where it is obtained and in what quantities it is needed.

Gunpowder is a mixture of sulphur with some other substances, so that when, in the fourteenth century, gunpowder was invented, sulphur sprang forward as an important element in the world. It has held its place to the present day by virtue of the increasing use of gunpowder, its growing use in many other lines of commerce and business, as well as its employment in making sulphuric acid.

The amount of sulphur used by the modern nations is small in comparison with the enormous tonnage of iron and coal demanded. Still sulphur is needed in so many different industries and in such a number of articles that we must have our own supply so we will not be dependent upon other countries.

Sulphur appears in nature in three different forms: First, in a free or native condition known as crude sulphur; next, it occurs in a combination with one or more metals forming what are called sulphide minerals.

Copper, iron, lead, zinc, silver, nickel, antimony, and mercury are all found combined with sulphur. Thus we have copper sulphide, lead sulphide and so on.

Then there are the sulphates, a combination of sulphur with oxygen and certain metals. These as a class are less important to us industrially than the sulphides. The sulphates occur in bulk and are widespread. Two of them are gypsum and barite.

From the sulphides we get practically all the sulphuric acid now used in this country. We obtain

it as a by-product in the smelting of the ores of copper, lead, zinc, and silver, or by roasting the pyrite which before the war was largely imported from Spain. It came as ballast in returning ships. Because of the inroads of the U-boats and the needed shipping tonnage for war supplies to our armies and our Allies, this supply of pyrite was cut off, and our country had to turn to other sources for its large needs of sulphuric acid.

We found that in an emergency crude sulphur can be used to manufacture sulphuric acid. Prior to the year 1900 nearly all the world's **SICILY'S** supply of free or crude sulphur **SULPHUR MINES** came from the huge deposits in the Island of Sicily, where cheap labor and large mines made a world monopoly. But the methods of mining the Sicilian fields were very wasteful, and the mining organizations did not improve their methods. When competition came, the result was that the Sicilian mines lost the world trade.

Sulphur deposits occur in many localities in the United States, including those that have been worked in a small way in Utah, Wyoming and other western states, but our domestic supply of sulphur now comes almost entirely from the Gulf Coast.

The story of the discovery and development of these Gulf Coast sulphur mines is a very interesting one. At a place now called "Sulphur," **CITY OF** **SULPHUR** a small town in Louisiana, a hole was put down in 1865 in search of petroleum. After they had gone through several hundred feet of quicksand, they bored through a mass of pure sulphur 100 feet in thickness. Nowhere else in the world is there known to be such abundance.

Men immediately began to contrive a method of reaching this fine body of pure sulphur. During the following thirty years, numerous attempts were made to mine the sulphur by the ordinary mining

shaft, as one would mine for coal. All the efforts resulted in hopeless failure. It was easy enough to put down an iron pipe a dozen inches in diameter, such as was used in oil wells, but quite a different problem to open a big shaft that would allow miners to reach the sulphur.

At first the main difficulty was the terrible side pressure from the quicksand which was met part **THE ENEMY.** way down. The sand pressed so hard **QUICKSAND** upon the shaft that it gave way and caved in. Finally the engineers succeeded in putting down a shaft of extraordinary strength that withstood the pressure of the quicksand. But when the workmen went down to mine the sulphur, they met with a great inrush of poisonous gases from the sulphur deposits, which seemed to show that it was not possible for men to work in the bed of sulphur even if they could reach them. It was then evident that some other method of mining must be devised to meet these difficulties.

Between 1891 and 1903 Herman Frasch solved the problem that today makes the United States independent so far as sulphur is concerned. **FRASCH** **PROCESS** The plan is called the Frasch process and is simply this: A well is put down to the sulphur deposits the same as when boring for petroleum and cased in with an iron pipe. This keeps out the water and quicksand. Within this well is put down another smaller pipe with a space left between; and within this pipe still another, so that there are three pipes, one within the other, with spaces between.

Through the outer or larger pipe they force down into the mines superheated steam, hot enough to melt the sulphur and turn it to liquid. Then through the inner of the three pipes compressed air is pumped to the bottom, and the force of the air **upon** the melted sulphur drives it up through the

medium pipe, that is through the middle space between the outer and inner pipes.

The sulphur comes up in a liquid state, and it is stored in great bins until it cools and becomes hard. It is then loaded on cars by means of great steam shovels. A number of wells are operated at the same time. When any one well ceases to flow satisfactorily it is abandoned and another well opened to take its place. The process, therefore, is to a very large degree mechanical, and it is wonderfully efficient.

A second great sulphur deposit was later discovered at Bryan Heights, Texas, near the mouth of **BRYAN HEIGHT** the Brazos River, forty miles south-
MINE west of Galveston. There is at this point also a good harbor which gives favorable shipping facilities. The productive portions of the mines here lie about one thousand feet beneath the surface, and it has been developed more recently than at Sulphur, Louisiana. We do not know how much comes from these two mines, but they are very large and will supply us for some time to come, though it seems best that the sulphur from them shall be used rather carefully at least while the war lasts.

We do not know how extensive are the sulphur deposits along our Gulf Coast, but the probability **GULF COAST** is that there are a number of deposits
ADVANTAGES like the two that are being worked. Geologists tell us that many similar areas exist. Some of these supply petroleum, others rock salt, and still others, sulphur. Sometimes all of these elements appear in the same place, but the mining operations are directed against only one of the three in any one place.

One of the advantages of these sulphur mines in the Gulf coast region is that they are near the sea, so the product can be shipped at small cost for

transportation. Another advantage is that they are near the oil fields where cheap fuel can be had. The two sulphur mines at Sulphur and Bryan Heights produce now over 98 percent of the entire country's output of sulphur.

While we have in our western states numerous lean deposits of sulphur, they have as yet but little output. It is therefore certain that without the Gulf deposits and the ingenious method of making them available, this country would have scarcely been able to meet successfully the war needs of sulphur and sulphuric acid.

The United States was one of Sicily's largest customers, but now we not only receive no sulphur from **AN AMERICAN MONOPOLY** that source, but we have even entered the world market as a growing competitor. There are small imports coming to our Pacific coast from Japan, but these are not very important now that the Panama Canal affords cheap water transportation from our sulphur supplies on the Gulf Coast. The United States is practically independent of the rest of the world as regards its supply of sulphur.

CHAPTER XXV

EUROPE, ITS CLIMATE AND WATERWAYS

Because our soldiers have been fighting in France, Belgium and Germany, in Italy, Russia and Siberia, we must get better acquainted with Europe. Its climate, its waterways and mountains, as well as its products and commerce, are of vital interest to us.

The forces that build continents were kinder to Europe than any other of the great land divisions **EUROPE A** of the world. Europe is really a great **PENINSULA** peninsula thrown out from the land mass of Asia to bask in the mild climate of the Gulf Stream. The Baltic Sea on the north reaches hundreds of miles inland to the heart of Europe, carrying the mild influence of the Gulf Stream with it; while on the southern border the Mediterranean extends more than a thousand miles to the shores of Asia. The Black Sea extends the sea advantages 3,500 miles eastward from Gibraltar. Branching off from these greater seas are numerous arms or smaller seas and gulfs, bringing the influence of the ocean to every section of the continent.

Europe has a wonderful coast line. Africa and South America resemble solid blocks of land without the advantages of climate and commerce that inland seas would bring. Even the United States, with its favorable location and its splendid commercial routes and an area nearly equal to that of all Europe, has only 5,200 miles of sea coast, while Europe has 20,000 miles.

Between these inland-reaching seas, lies the great land mass of Europe, a vast peninsula fringed with

a succession of smaller peninsulas, each having the immense advantages of a long coast line. Greece, Italy, Spain, Scandinavia and Denmark fall but little below so many islands in length of sea coast. France faces two seas, Russia three, while England is an island kingdom.

This long coastline with the numerous peninsulas explains why there are so many different nations in Europe. The many different languages has in some ways hindered progress.

Nearly all of Europe lies farther north than New York. Both New York and Chicago are farther **EUROPE'S** south than Rome or Constantinople, yet **CLIMATE** Italy has a subtropical climate. All of Europe except the Mediterranean peninsulas lies farther north than Minneapolis, which is one of our coldest cities. London with its mild winters is on the same parallel as frigid Labrador. Both Germany and England are as far north as Canada.

What accounts for the mild weather conditions of Europe? In the first place the mountain systems of Europe run east and west. There are in Europe no plateaus surrounded by mountains. The whole continent lies open to the warm, moist westerly winds blowing from the Atlantic. The climate of Europe is much milder than that part of North America which lies in the same latitude, because so much of it lies near the ocean or its branches. These ocean waters are warm and the winds which blow from the west are warmed by passing over them. Thus they carry the heat and moisture far inland over Europe.

There are three climatic regions of Europe. The Mediterranean countries have a mild climate with winter rains. The Alps and Pyrenees keep out cooler winds from the north. Our soldiers in Italy will therefore not have to face severe weather unless they are sent to fight among the Alps.

The west European region of England, France,

Belgium and Germany is never very hot nor very cold, but is usually very moist, with the heaviest rainfall in the winter. One of our aviators writes that he got lost in a rain cloud two miles deep and thinking he was over France descended and was peppered with shrapnel by the Germans, but escaped. Our soldiers in the trenches must endure this wet climate, which is very trying in winter. The mild climate and abundant rainfall, together with a fertile soil make western Europe very productive.

The east European region, comprising chiefly Russia, is marked by greater extremes of heat and cold, because it is farther from the sea. It was king winter that really defeated Napoleon in his attempt to conquer Russia. Russia's north coast reaches into frigid latitudes, but the mild Gulf Stream bathes its shores and keeps away the severest extreme. The seaport of Archangel, however, freezes up in the winter. But since the war began, Russia, with the help of American engineers, built a new railroad reaching farther north to the shores of the Arctic at Alexandrovsk, which, while farther north than Archangel, receives the direct aid of the Gulf Stream and thus its port is open the year round. It was here on the Murman coast that the Allied soldiers, including our "Yanks," landed in the summer of 1918 and pushed southward along the railroad to aid the benighted Russians.

How different America would be, both as to climate and history, if the Appalachian and Rockies ran east and west across the continent. The trend of the Alps divides Europe into climatic belts with sharply different products. This difference in crops north and south of the Alps encourages the exchange of goods and stimulates commerce.

It is well known that the sea is the cheapest of all highways, for there is no cost for upkeep as there is for railroads, no up-stream pull as in rivers, and the

ocean steamer can strike off in any direction. Irregular coast lines with their gulfs and bays with numerous rivers and canals make short and easy communication between the interior and the sea. The only comparison to Europe's sea routes would be the American Great Lakes if they were accessible and navigable at all seasons by ocean vessels, but commerce on them is limited to a part of the year and large ocean vessels cannot enter even in the summer.

The commerce lines of Europe are interesting. Two great traffic trunk routes are furnished by the **COMMERCE BY WATER** southern and northern seas—one route skirts southern Europe to the Black Sea, and the other reaches into northern Europe to the Gulfs of Finland and Bothnia. There are secondary heavy traffic routes also which are feeders to the main water routes. The feeders are the navigable bays and rivers and the railroads, which, like the rivers, run in most cases direct to the sea, carrying inland products down to the ocean ports, and taking back goods from abroad.

Along the southern route from Gibraltar to Constantinople there are but few navigable rivers to act as feeders. The mountain wall of the Alps shuts the Mediterranean away from the waters of the back country, but the low shores of the Black Sea permit that body of water to drain much more than its proportional share of Europe.

The Danube drains the very center of Europe and is navigable throughout most of its length. In **THE DANUBE** recent years it has been made an international highway. A canal has been cut through the swampy delta of its mouth so the shipping may avoid the dangers of the multitude of the broad and shallow mouths. Ocean-going steamers ascend to the Roumanian ports of Braila and Galatz—there to take the grain cargoes that have come

down in barges through the Iron Gate from the plains of Hungary. This explains the wish of the Central Powers to control the Danube to its mouth.

Much of this down-stream traffic on the Danube is destined for the lower Rhine valley. It might save thousands of miles by moving directly up the Danube and overland or through shallow canals, but the cost of railroad or even small barge transportation is too great in comparison with the river-sea route, even though the latter is many times longer. Thus much commerce passes down the Danube where ocean steamers bear it through the Black Sea, the Dardanelles, the Mediterranean and up the coast to the Rhine valley.

The Black Sea traffic is further enriched by the steamers on the Dniester, Dnieper and the Don **RUSSIA'S OUTLET** rivers and by the South Russian railways which help to assemble the Russian wheat and corn at Black Sea ports for water transportation to the outer world. Here we get the basis for Russia's long ambition to control the Dardanelles. This war has shown her fear of being cut off from the world by war, a well founded one. Russia ought to have a free outlet through the Dardanelles and will doubtless get it at the close of the war.

The great Northern Sea route penetrates as far as Petrograd. This route is favored by being fed **THE BALTIC ROUTE** by navigable rivers, among which are the Rhine and Elbe, which must be classed as of the first magnitude, if measured by the commerce that they carry. The Elbe carries down to Hamburg products of central Germany and of Bohemia. The Rhine has, with great labor and expense, been made and kept navigable from the dikes of Holland to the waterfalls of Switzerland. The Rhine valley is the greatest industrial region on the continent and has the most efficient and extensive

river transportation in addition to the busy railroads that run parallel to the river.

This region of northwestern Europe has the most fully developed transport system in the world, all of which is due in large measure to its many avenues to the sea on account of its gently sloping surface and easy drainage. It is by ship that the heavy freight of Europe is carried. All freight traffic in which economy of cost is more important than economy of time, goes by water. Canals are numerous in the leading countries of Europe and very useful. They are not so economical as ocean carriage, but afford cheaper transportation than railroads. We read much of the canals of France where the armies are fighting.

The efficiency of Europe's water routes and the important part they perform in her commerce is shown by the comparatively small railway mileage. Europe has 20,000 miles less railway than the United States, although the area is slightly larger and the population four times as great. Railways are not so necessary where there is such a wealth of waterways so well utilized.

America may justly boast of her great railway mileage. It is a wonderful achievement in spite of **EUROPE'S** great continental handicaps. It is possible that by mechanical improvements, unity, and system of arrangement, America may get as efficient service as Europe, but we must utilize our water possibilities first. The many independent states of Europe form a bar to such a thorough organization of railway traffic as exists in the United States where uniform regulations exist over a wide area enabling railroads to perform wonders in overland transportation that have not been duplicated elsewhere. But again, if we are to compete with Europe we must have cheap transportation and so need to utilize our rivers and to construct canals.

Europe's wonderful advantages in climate, productions and commerce have thus far failed to bring the common people the freedom and comfort that most countries of America and the British Empire possess. This is due to the fact that the common people of Europe in the main have not been educated. They have not the opportunities or benefits of a public school system like ours, where the poor child has equal advantages with the well-to-do. The common people of Europe have largely been held down by the ruling classes and been kept ignorant. This is what ails poor Russia. The war will doubtless bring new hopes to them. The first great need is for free education, which forms the basis for self government.





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